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Lang et al.

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(45) **Date of Patent: May 15, 2012**

(54) **SAFETY HARNESSES, CONNECTIVE RING ATTACHMENTS FOR USE IN SAFETY HARNESSES AND BACK PADS FOR USE IN SAFETY HARNESSES**

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A62B 35/00 (2006.01)

(52) **U.S. Cl.** ..... **182/3**; 182/4; 24/265 AL

(58) **Field of Classification Search** ..... 182/3, 4; 24/264 AL; 16/267, 268, 269, 303, 330, 16/341, 344, 415, 416, 419, 420
See application file for complete search history.

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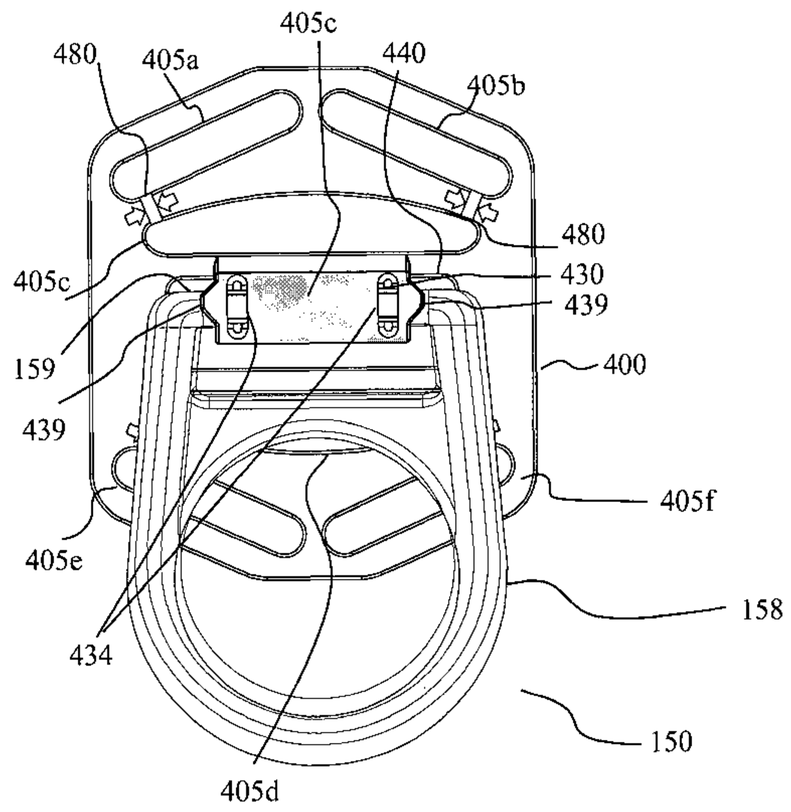
(57) **ABSTRACT**

A back pad system for use in connection with a safety harness which includes at least two spaced back straps and a connector adapted to be connected to a line or lanyard includes a back pad having passages through which the two back straps can be passed to be crossed over the connector, an attachment to which the connector can be moveably attached, and at least one member that captures the connector in an upright position upon application of force such as manual force (either directly or indirectly) to the connector to move the connector to the upright position. A back pad for use in connection with a safety harness includes at least two spaced back straps and a connector adapted to be connected to a line or lanyard. The back pad includes a base comprising passages through which the two back straps can be passed to be crossed over the connector and at least one load indicator. The load indicator includes an area of reduced strength in the base so that the area visibly distends or breaks upon the back pad being subjected for a substantial load. The substantial load can, for example, be predetermined to be at least approximately 450 pounds of force. The area of reduced strength can, for example, be an area of reduced thickness. The back pad can, for example, include a plurality of areas of reduced thickness.

5 Claims, 16 Drawing Sheets



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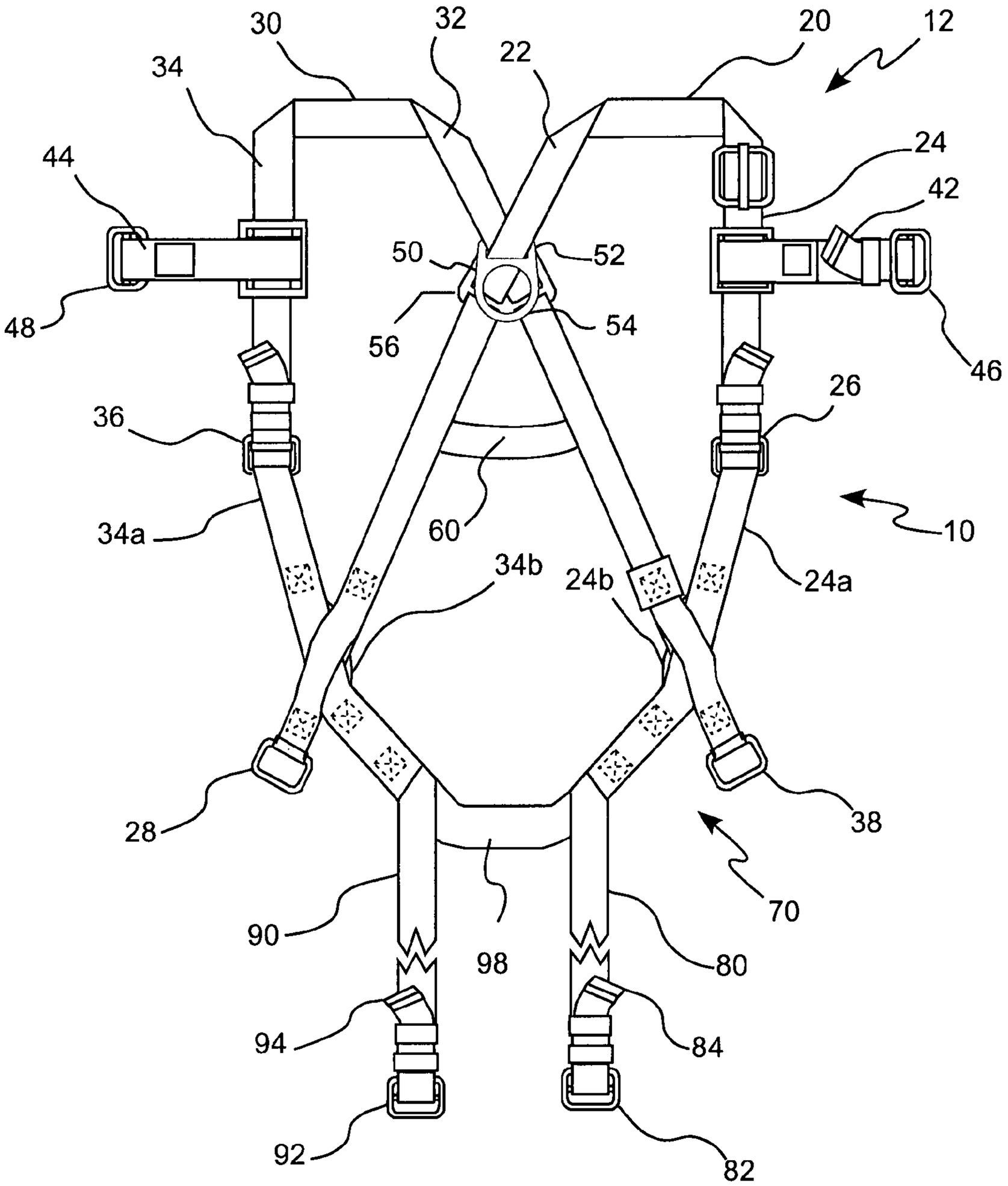
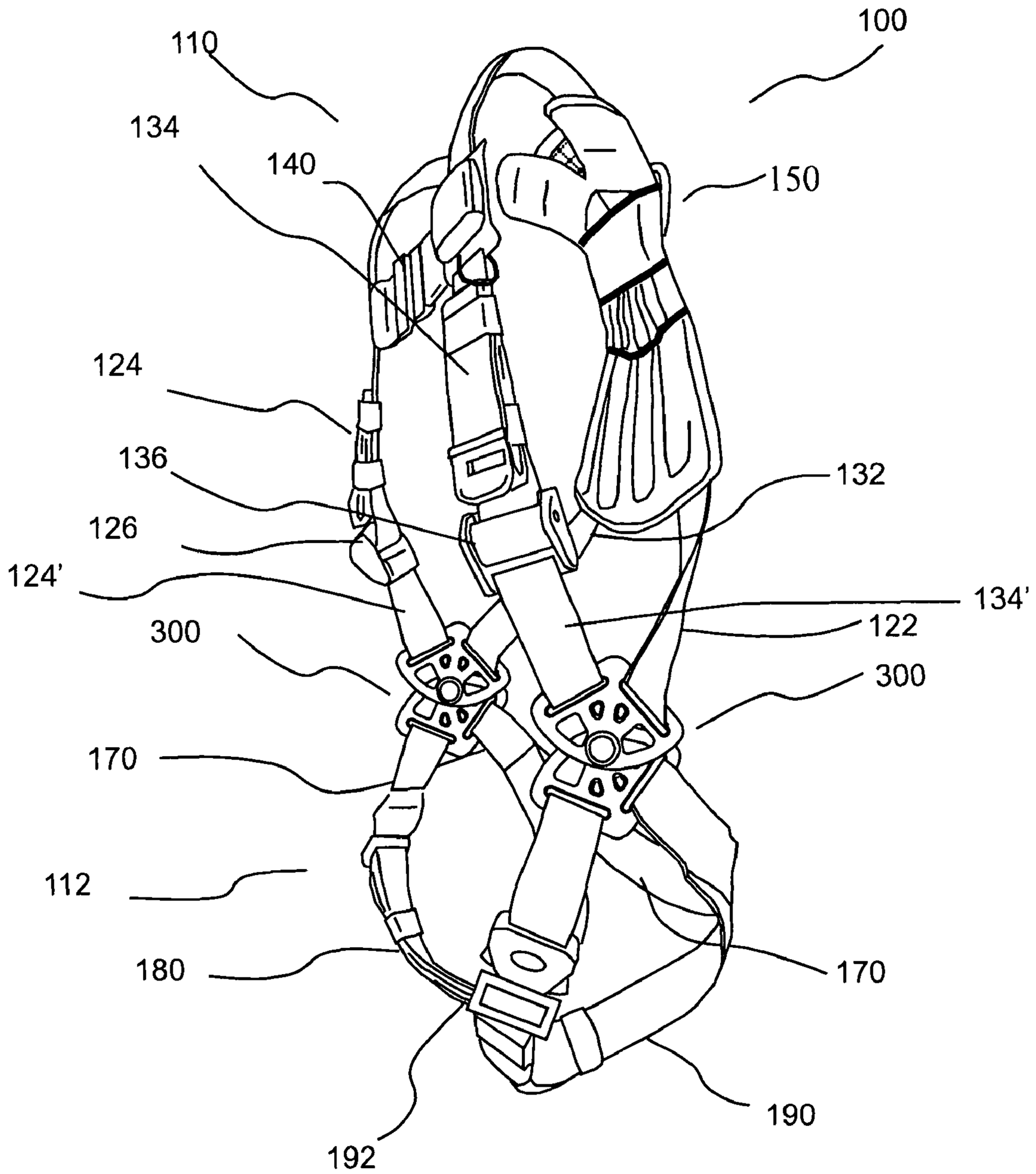


Fig. 1
(Prior Art)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110
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134'
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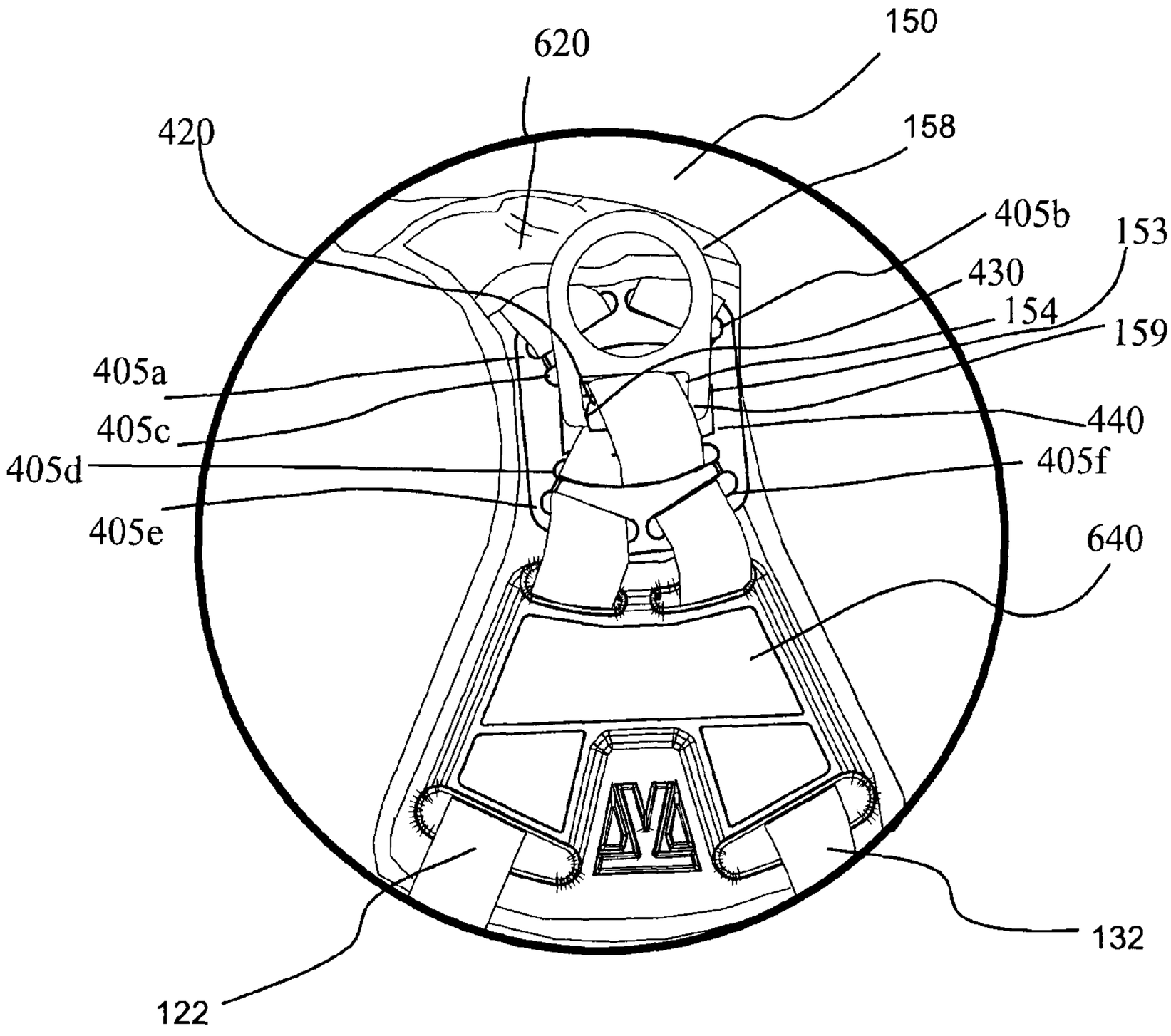
Fig. 2A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405a
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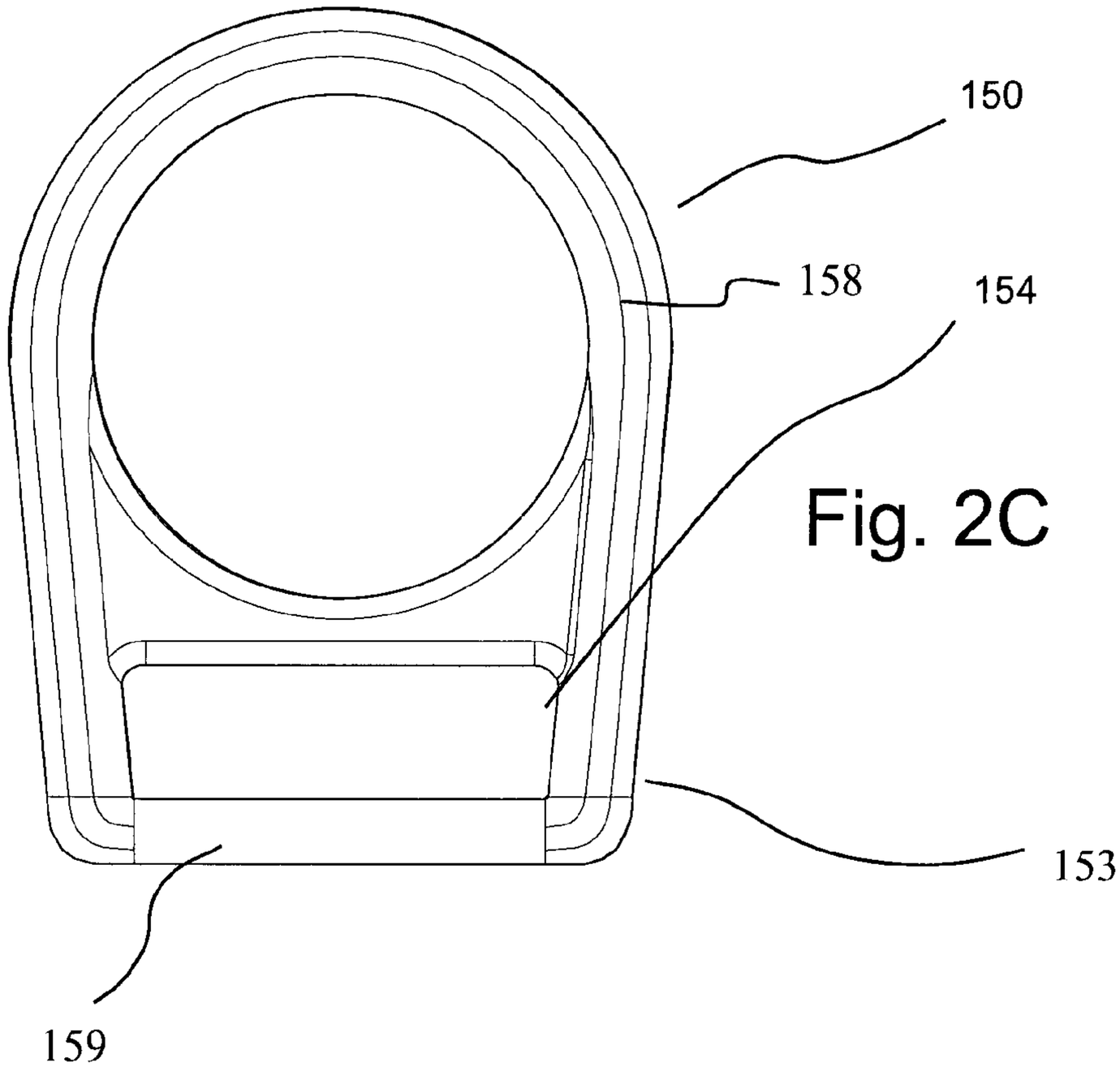
405d
405f
405e
640
122
132

Fig. 2B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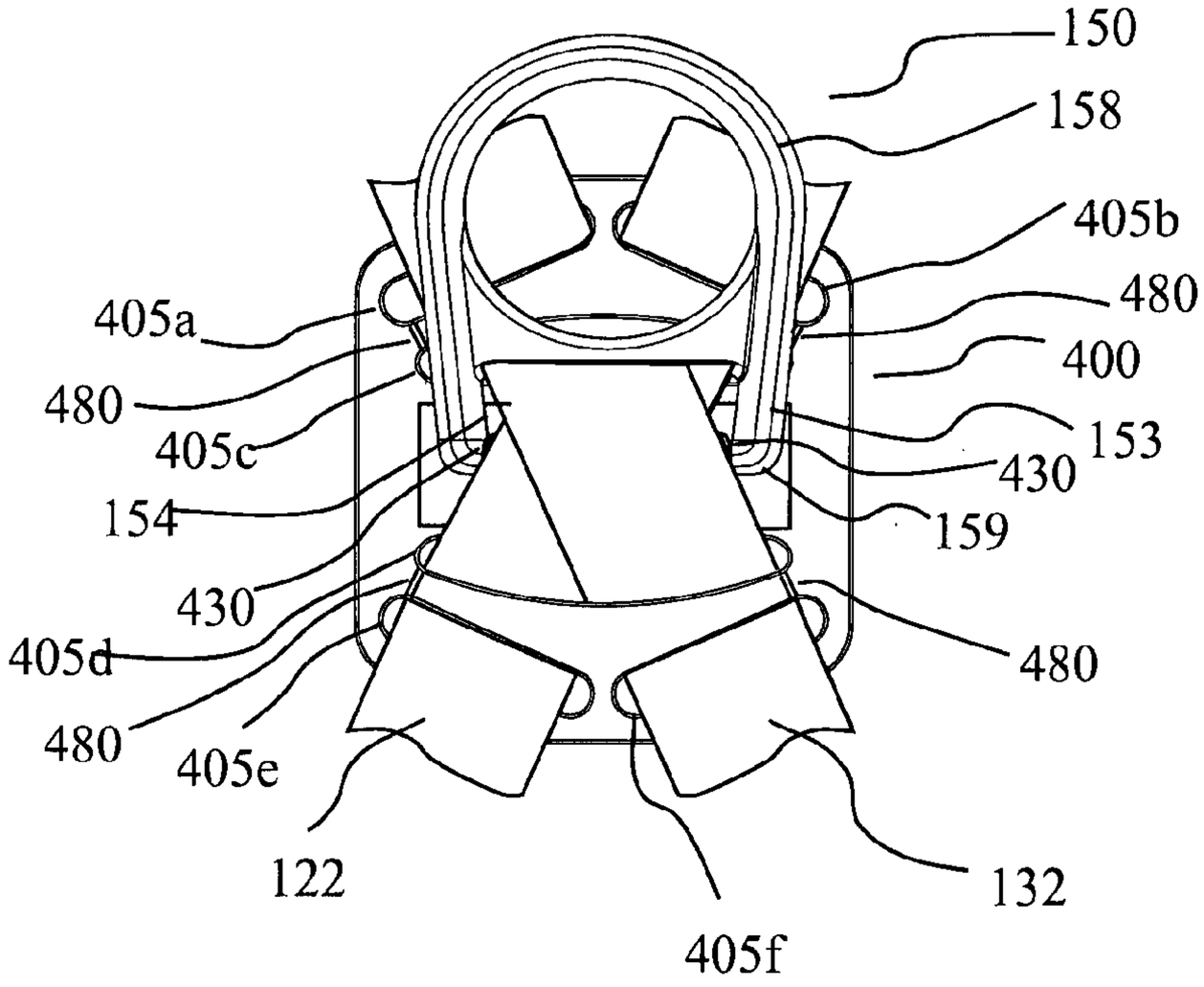
158
154
153
159

Fig. 2C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405f
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405d
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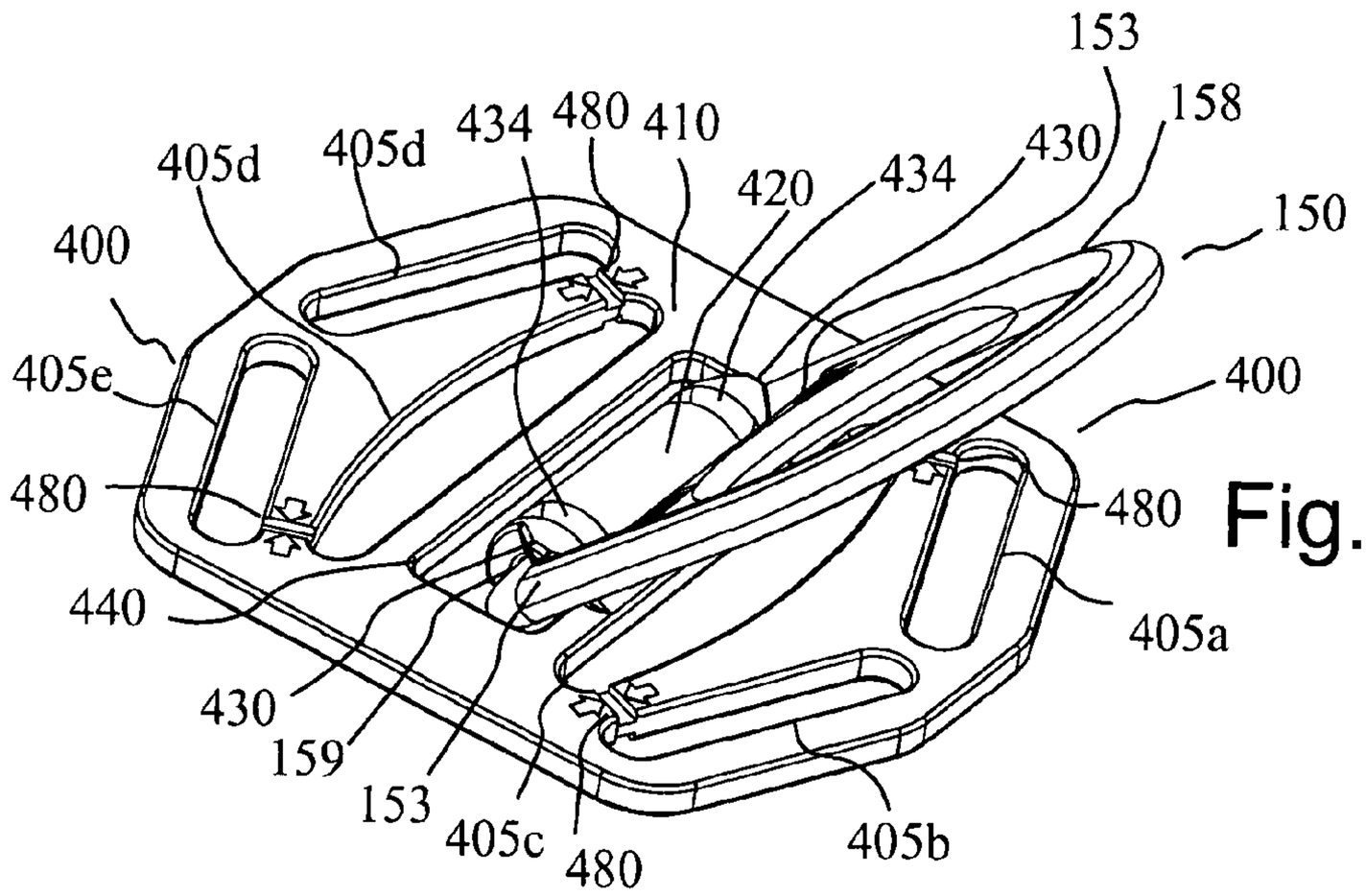
154
405c
480
405a

Fig. 2D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480
440
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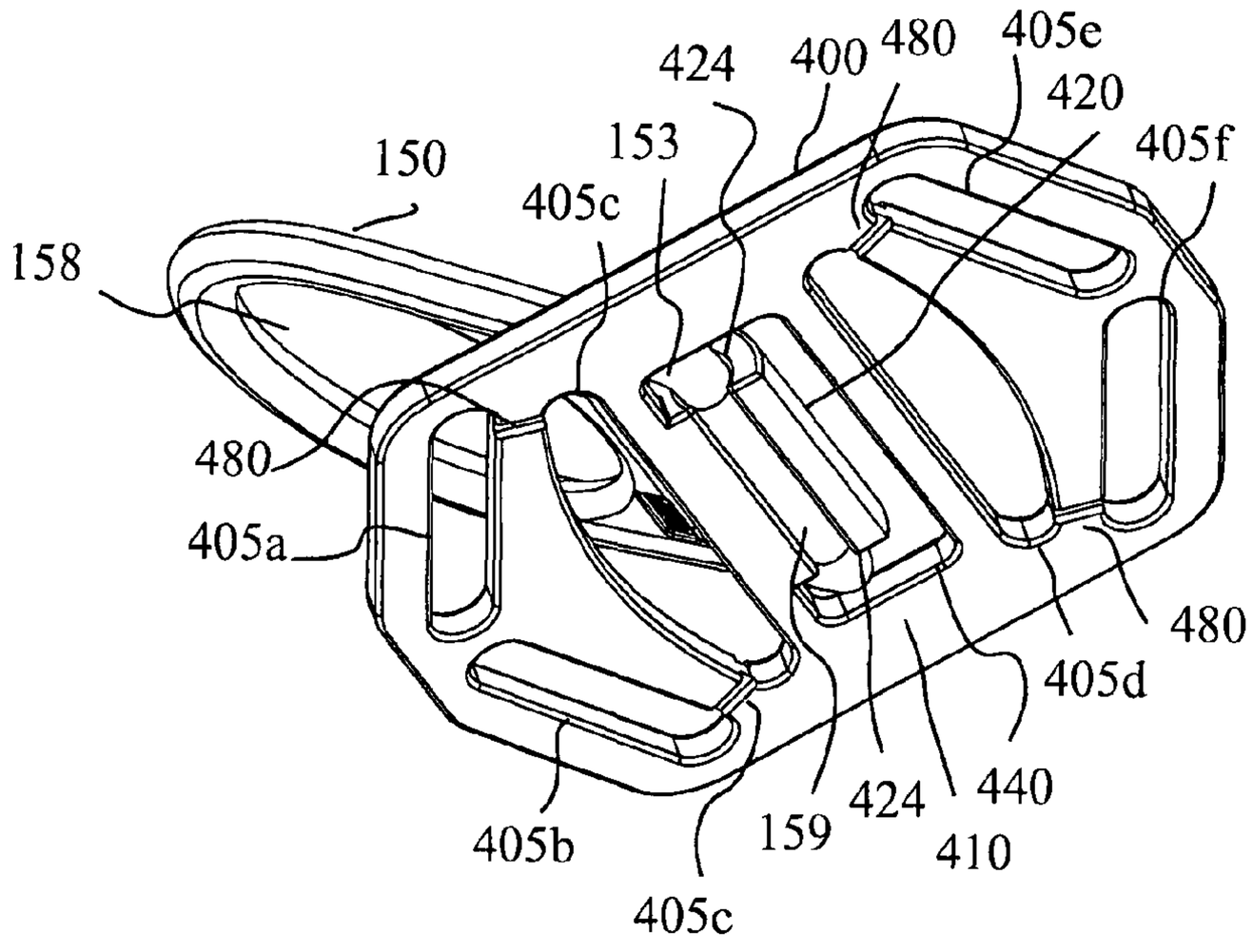
405d
405d
434
480
410
420
434
430

Fig. 3A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405a
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405c
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405d
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405e
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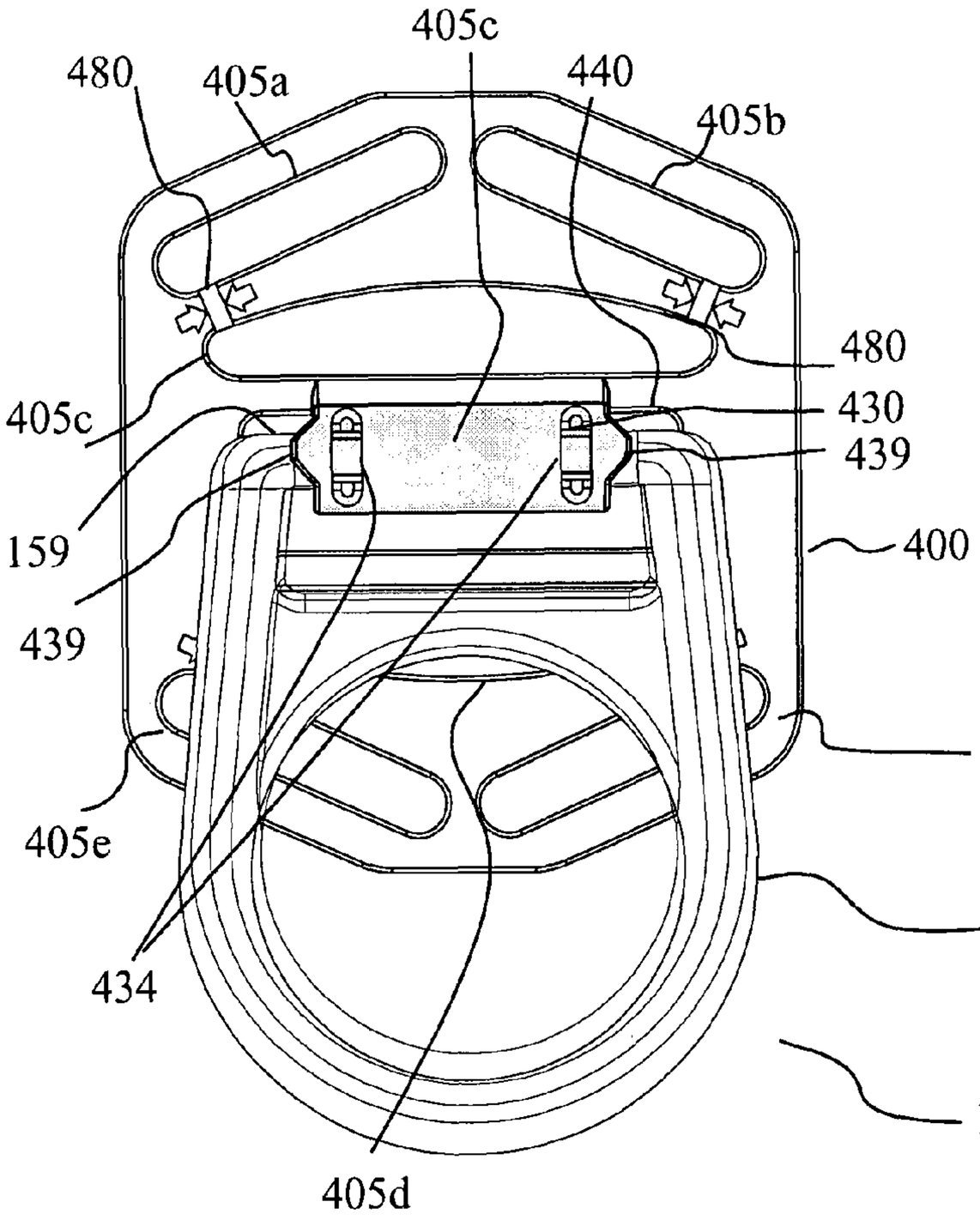
424
153
405c

Fig. 3B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405f
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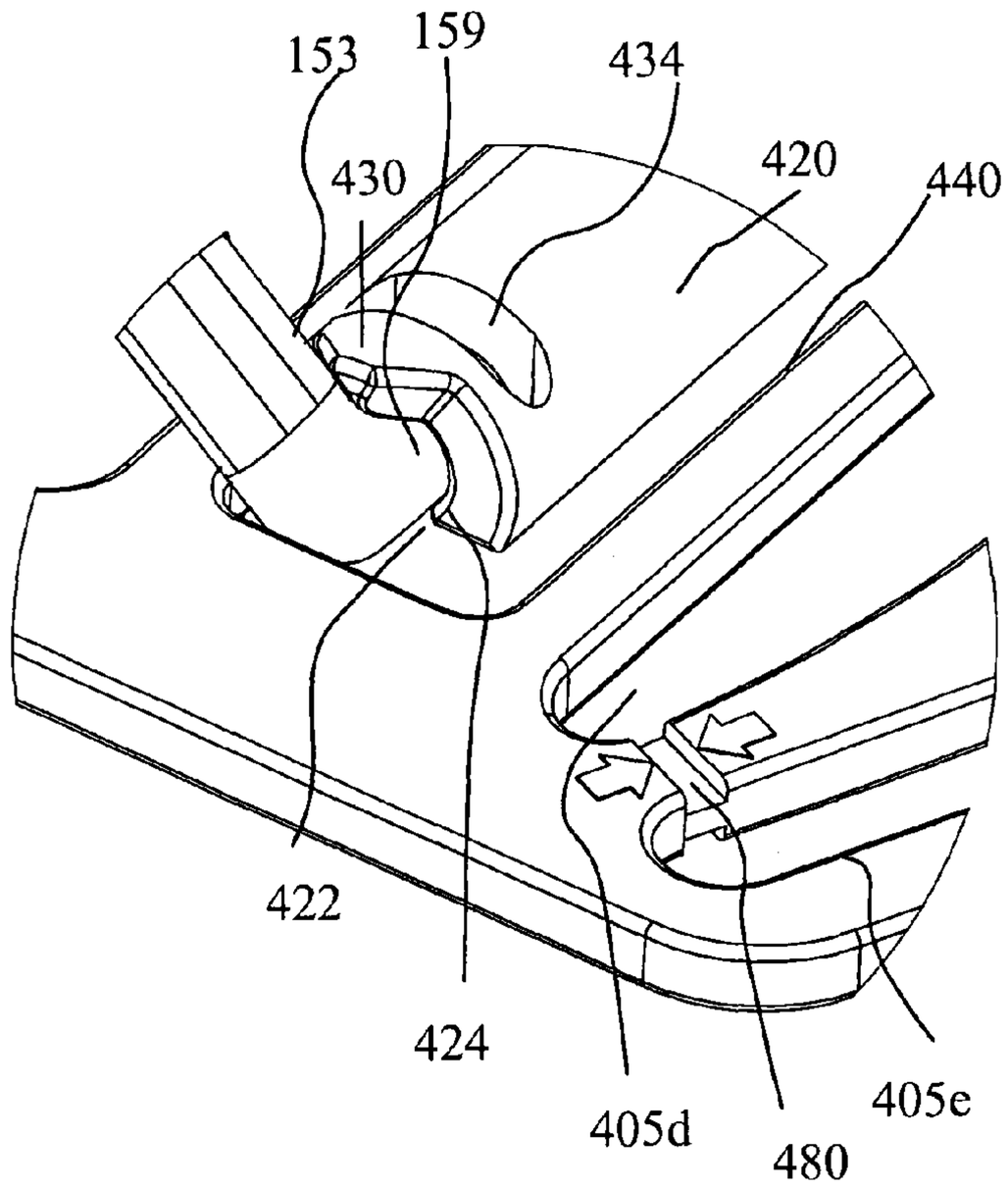
150
405d

Fig. 3C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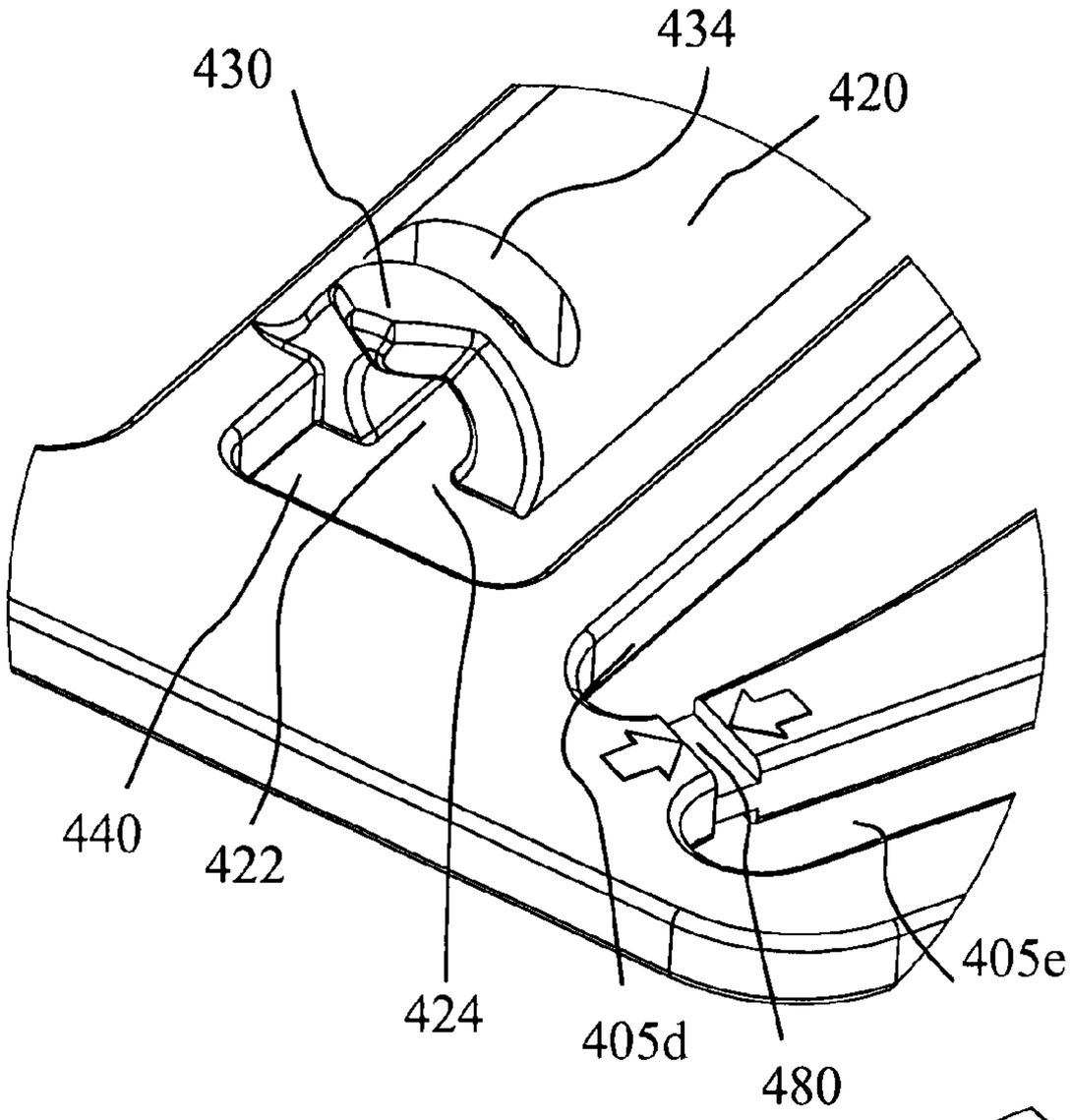
405d
480
405e

Fig. 3D



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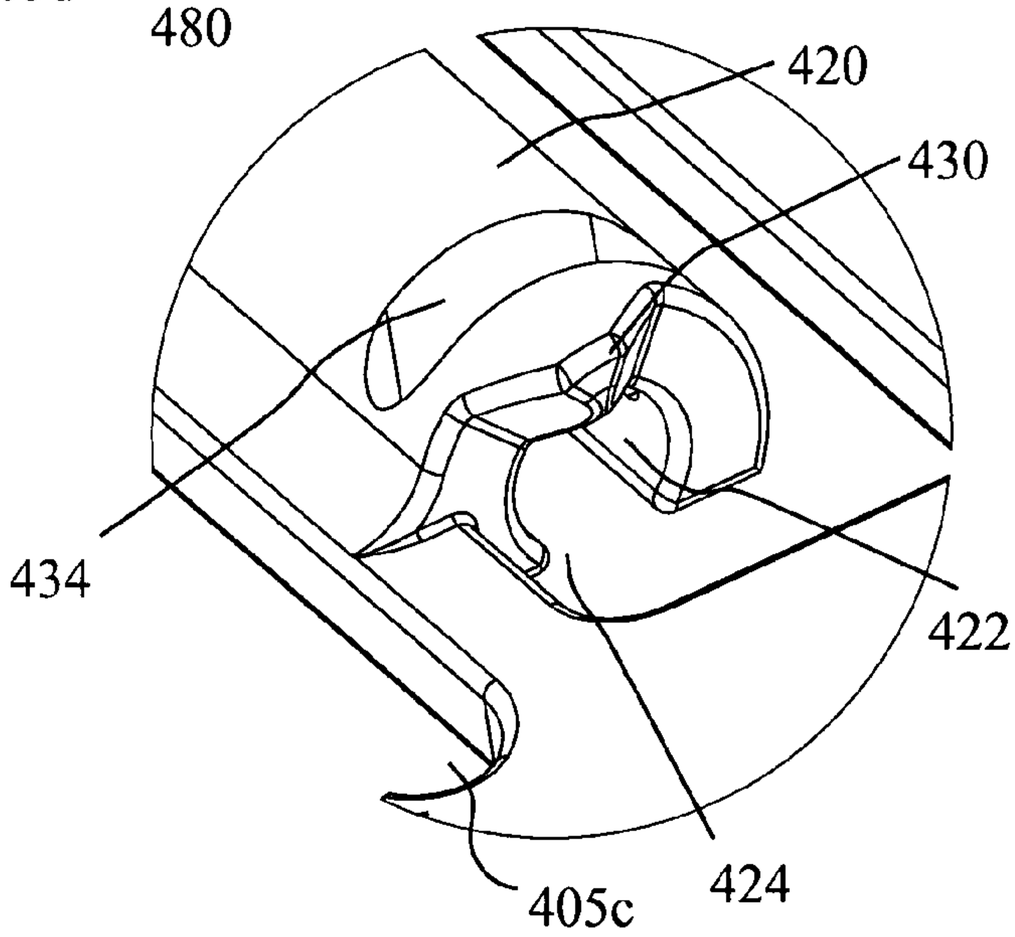

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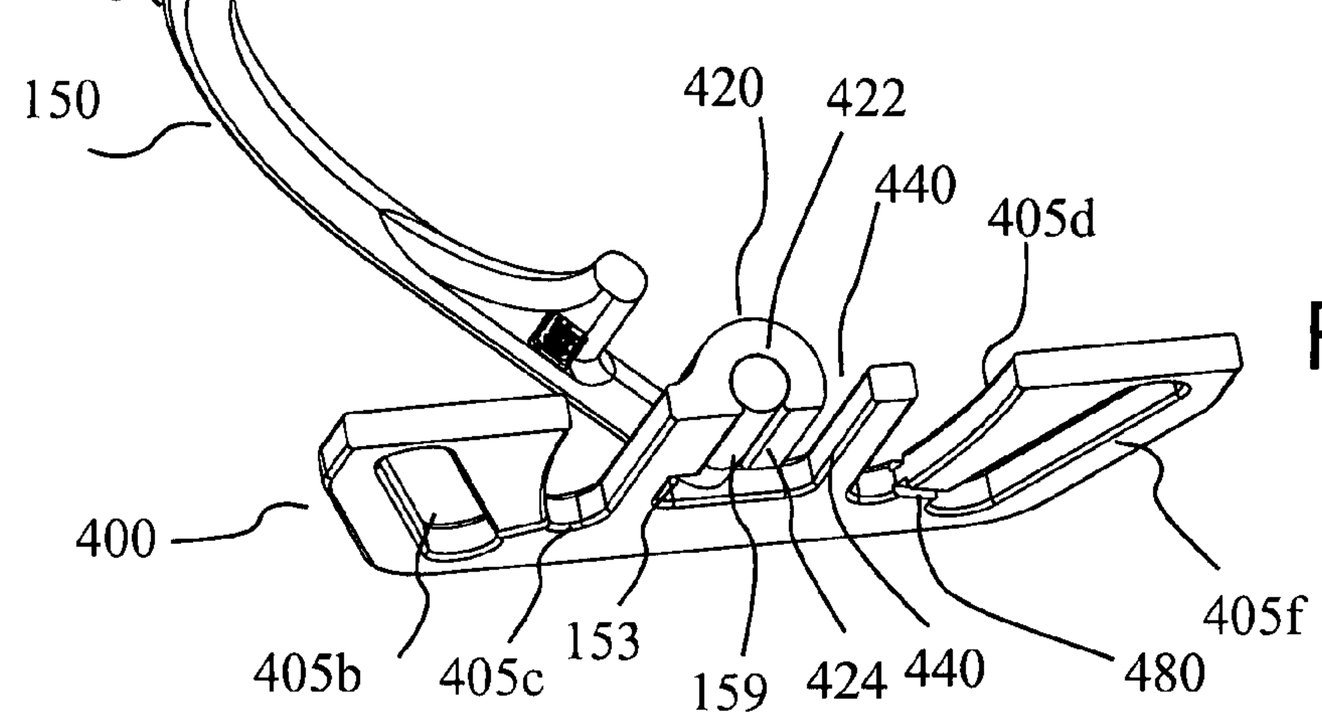

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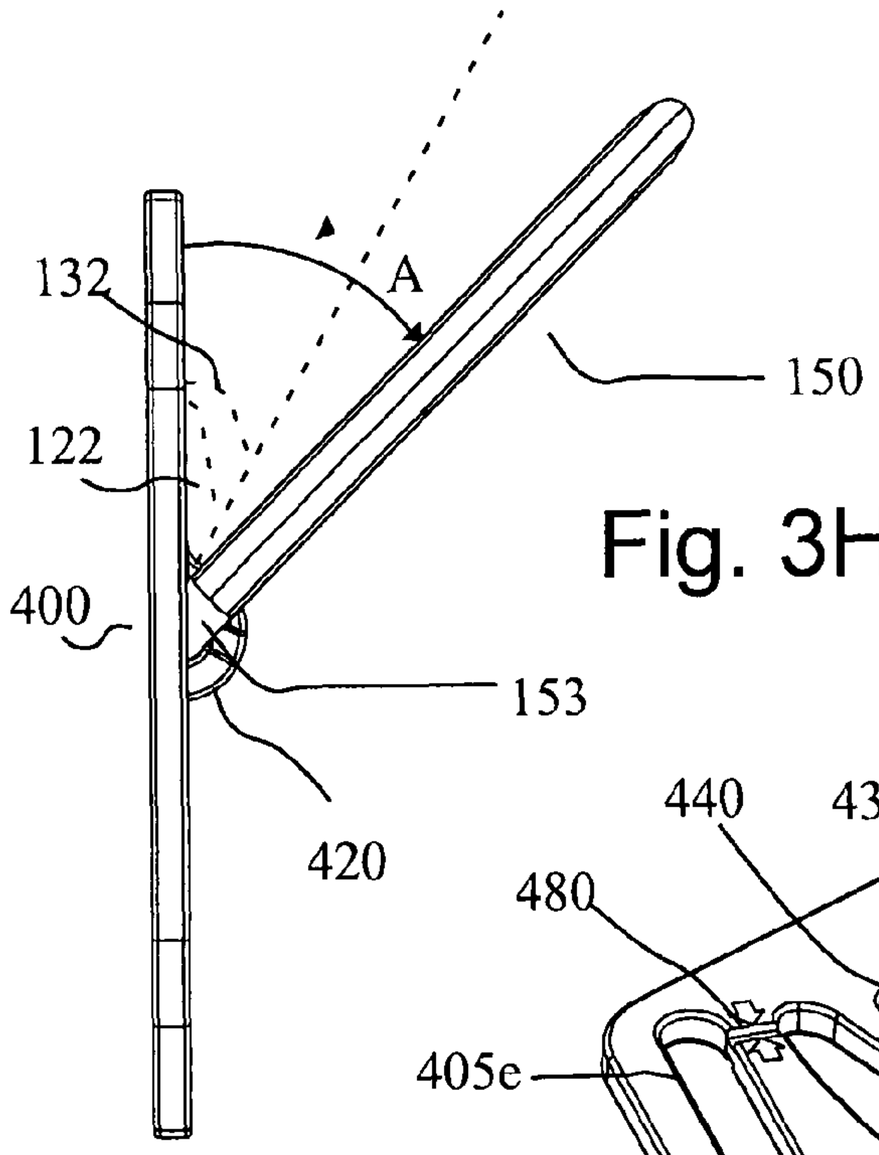

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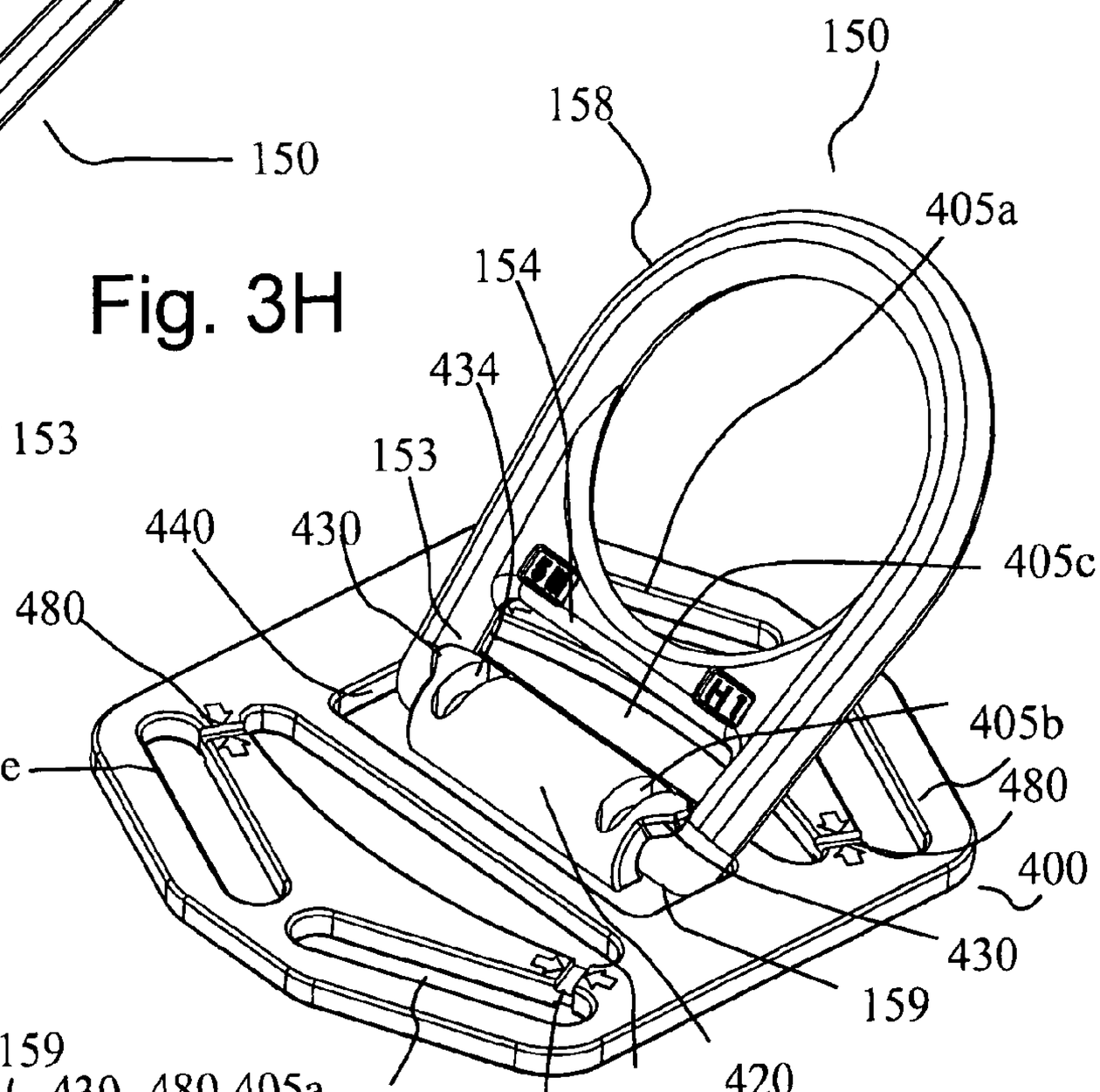
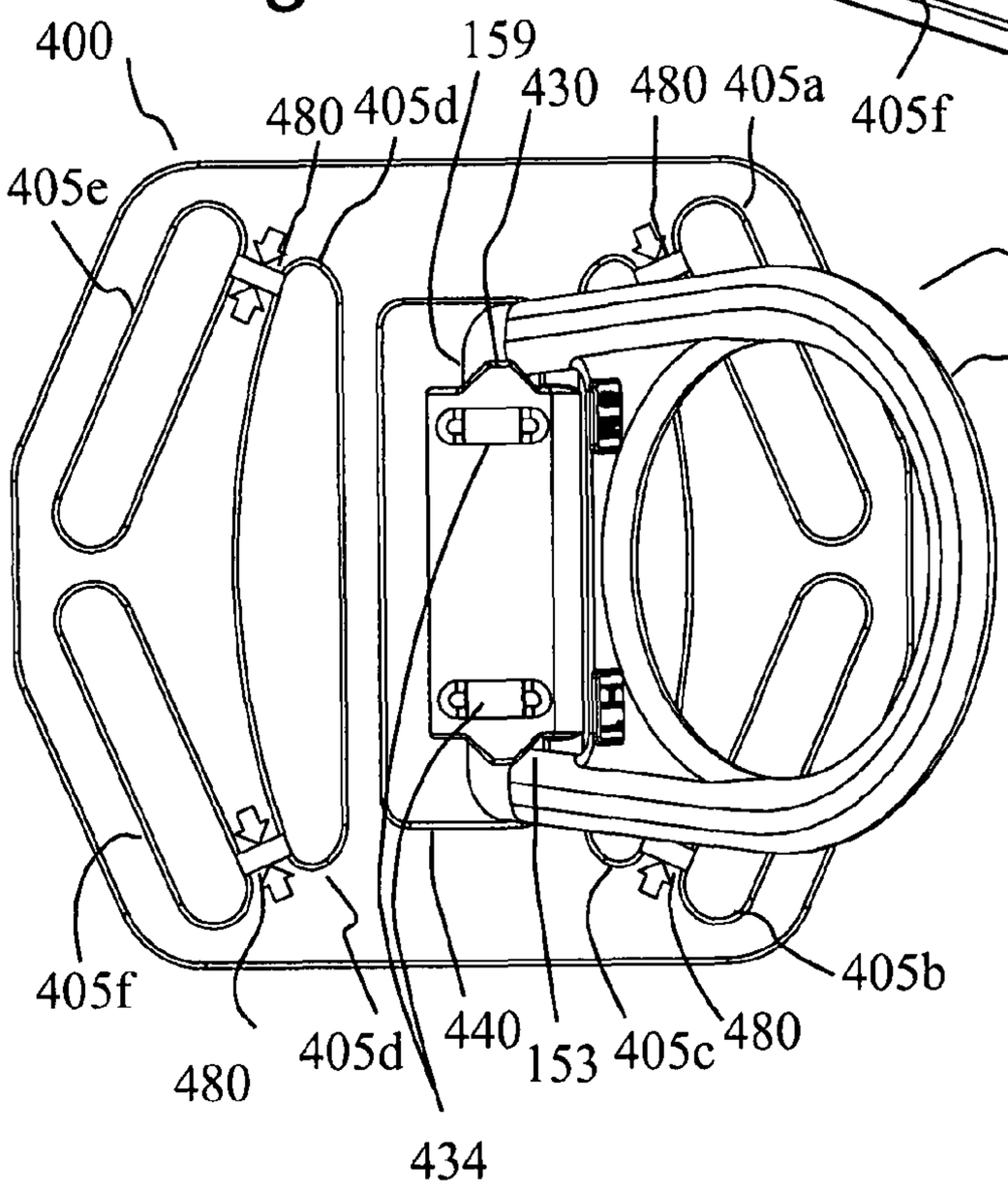
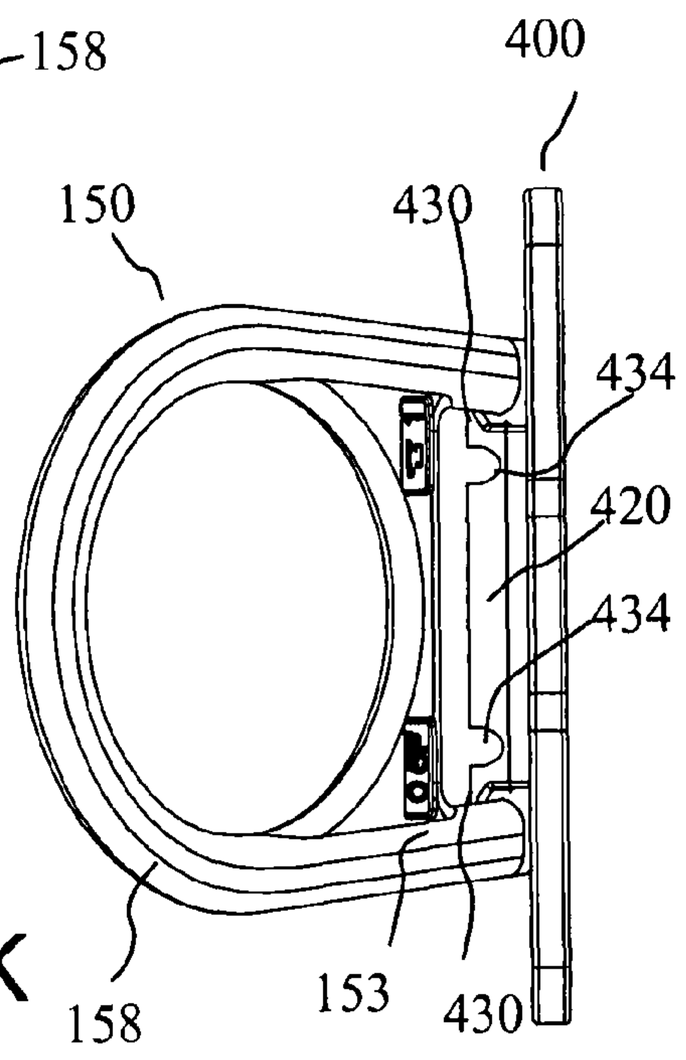


Fig. 3I

Fig. 3J





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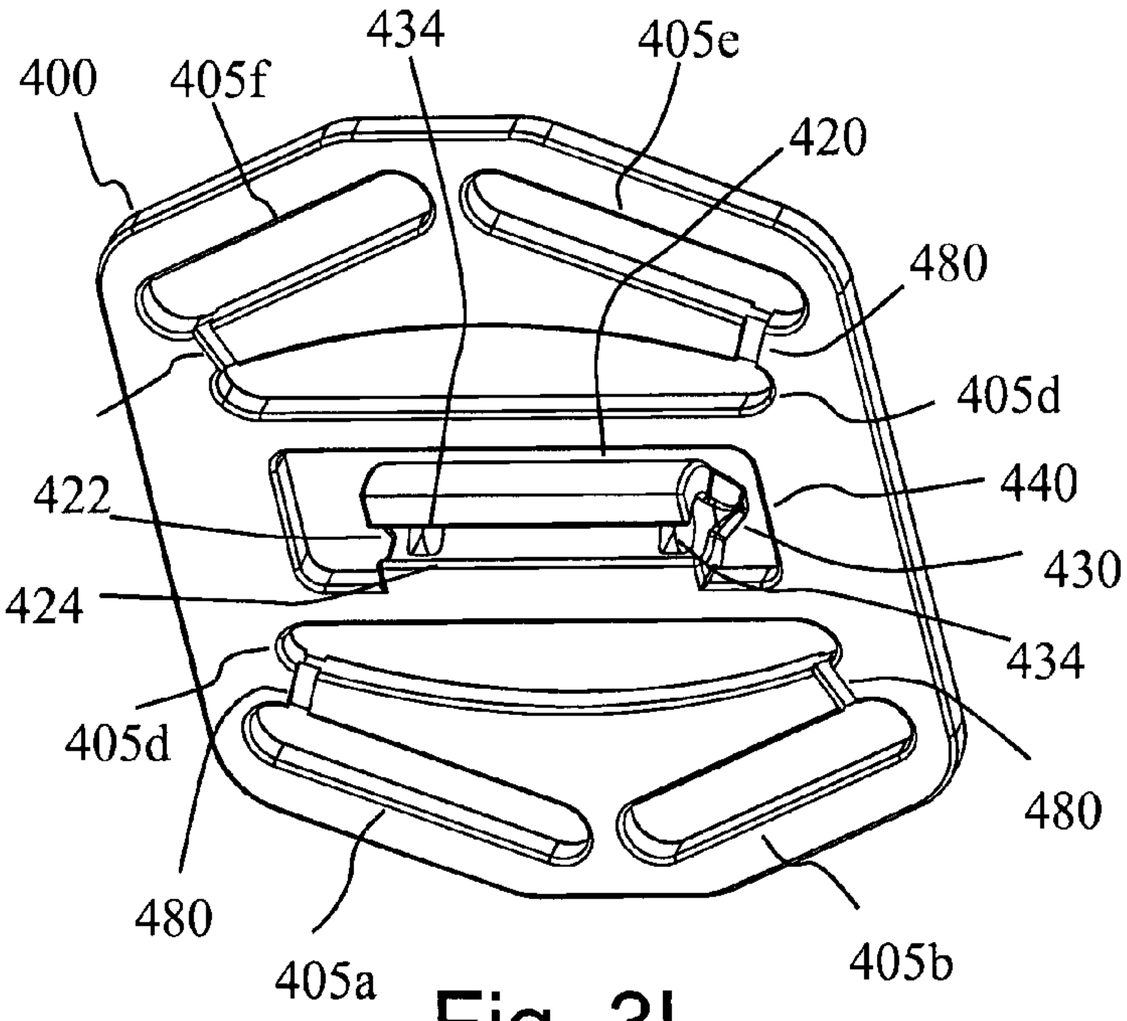

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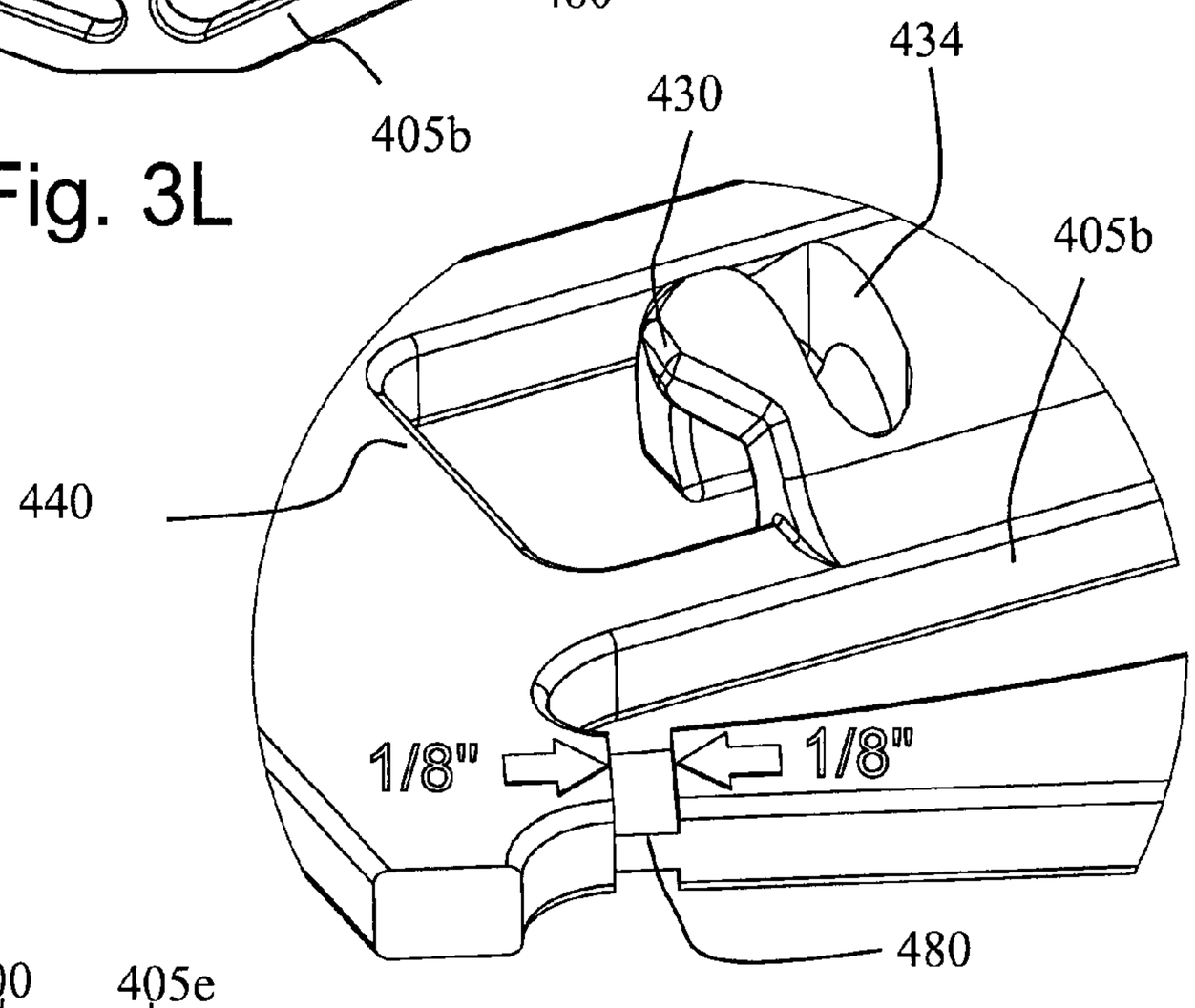

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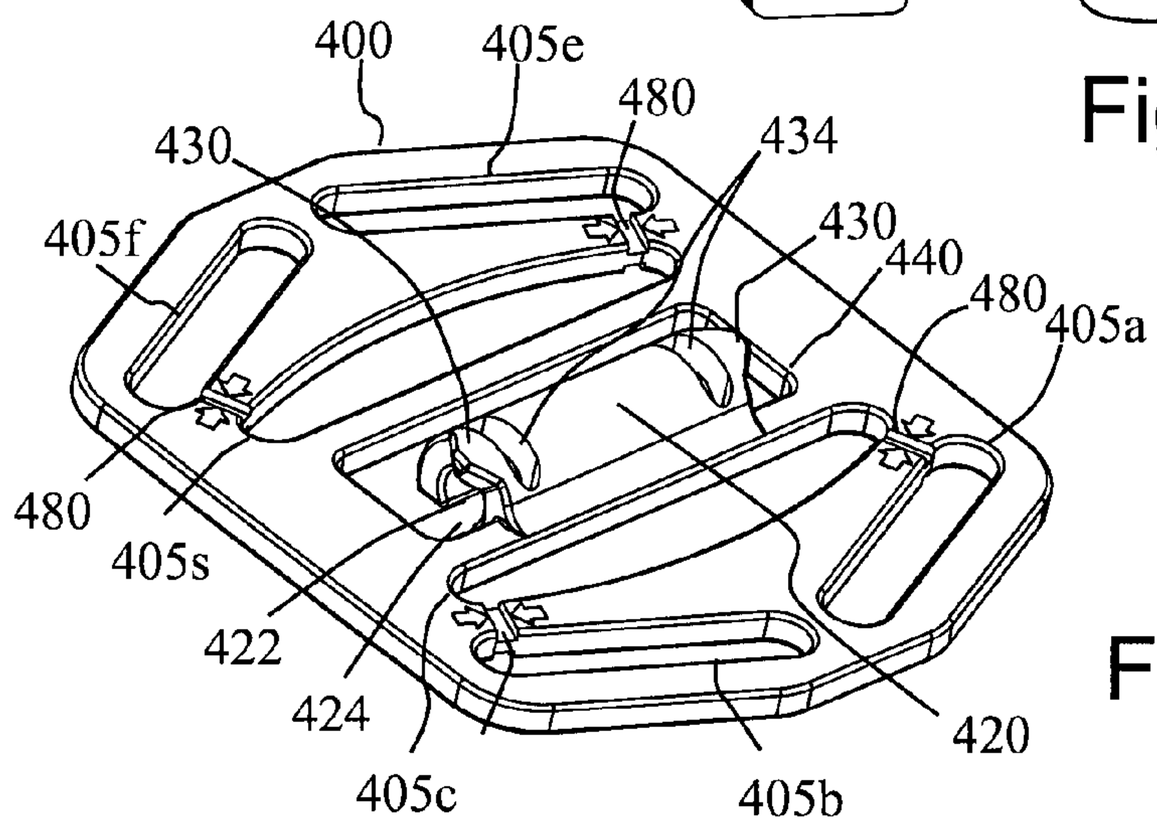

Fig. 3N

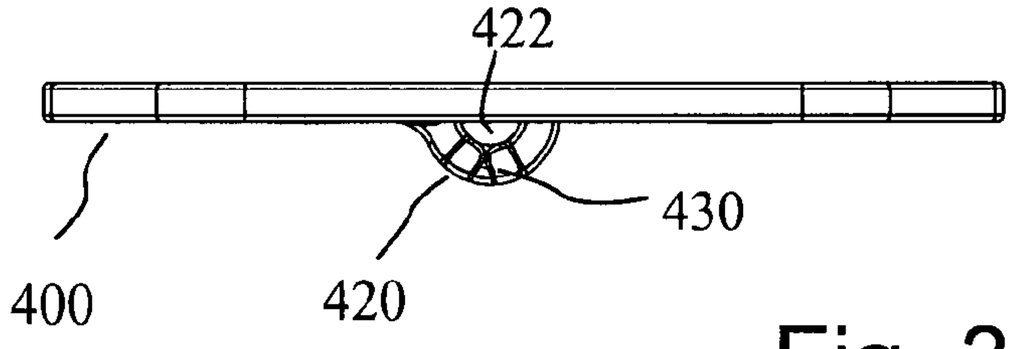

Fig. 3O

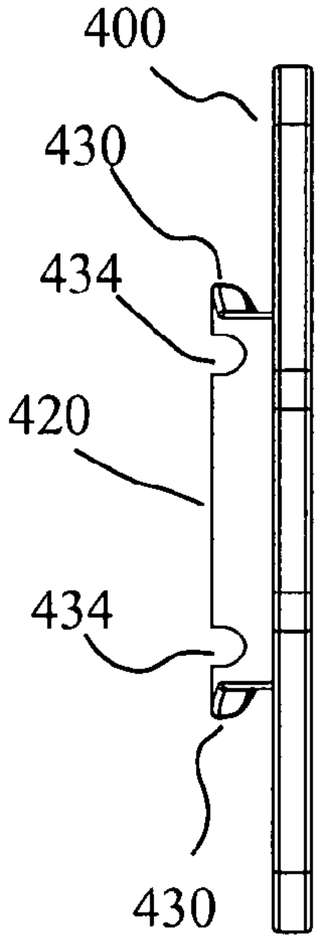

Fig. 3P

Fig. 3Q

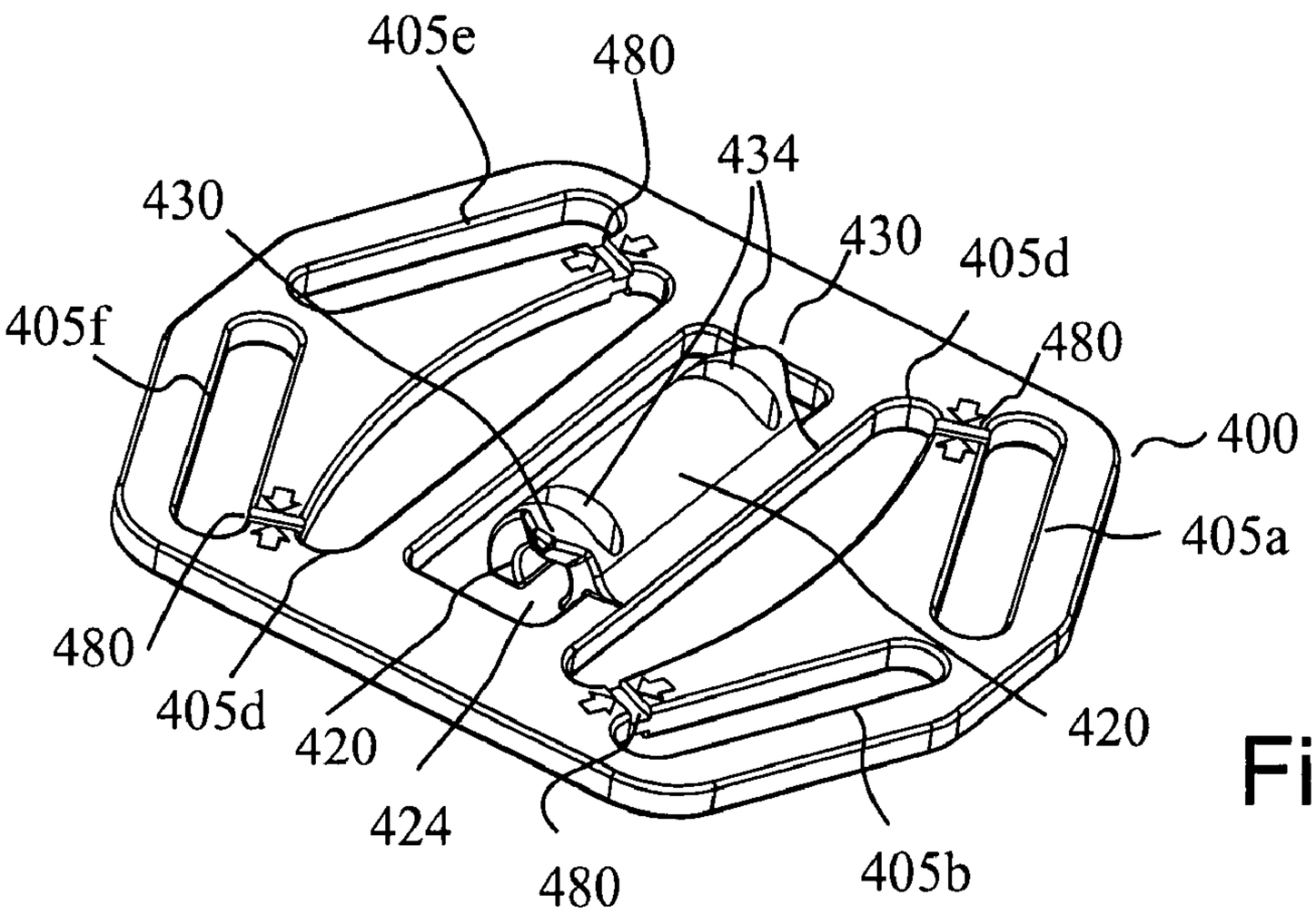
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Fig. 3R

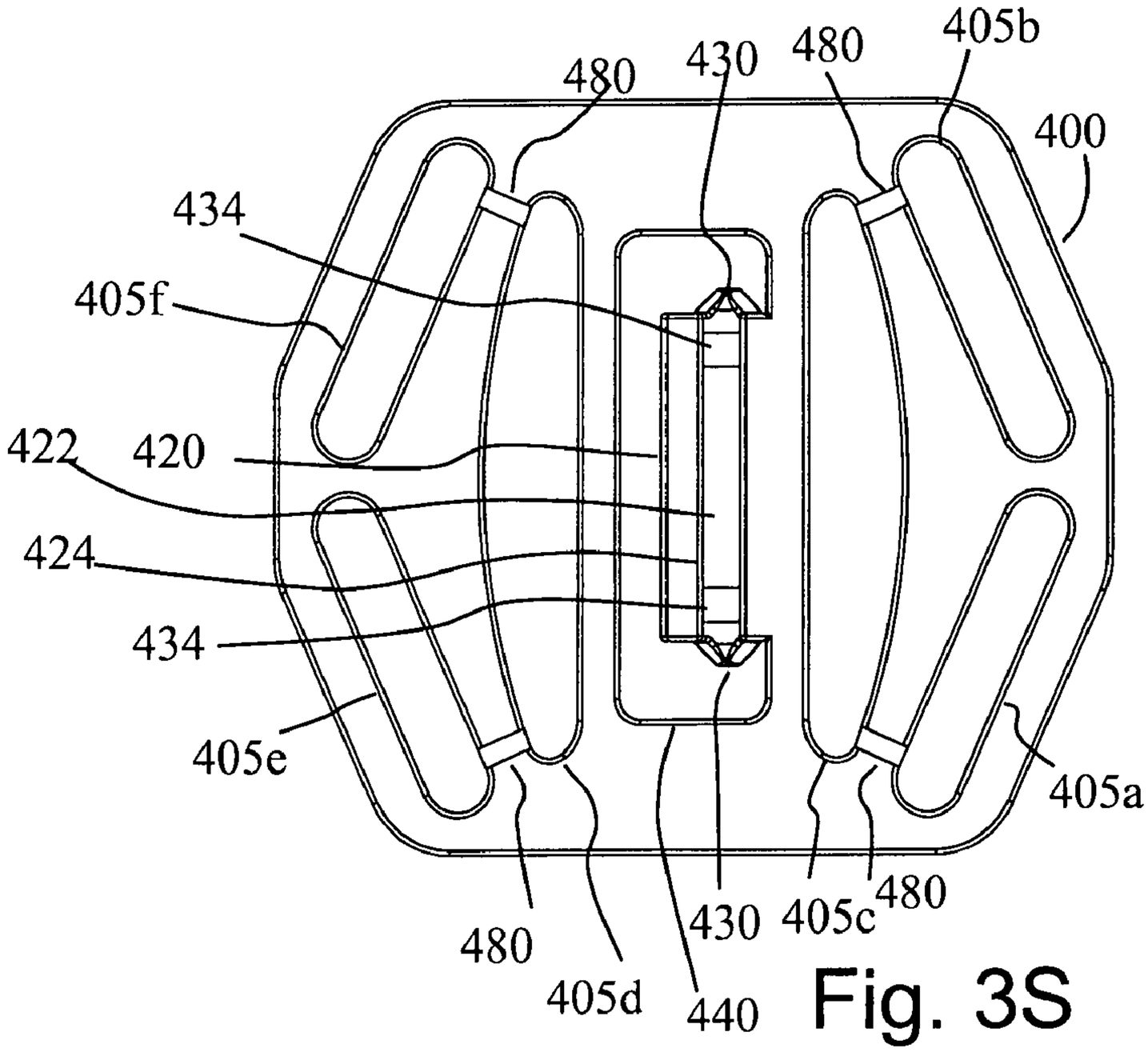
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Fig. 3S

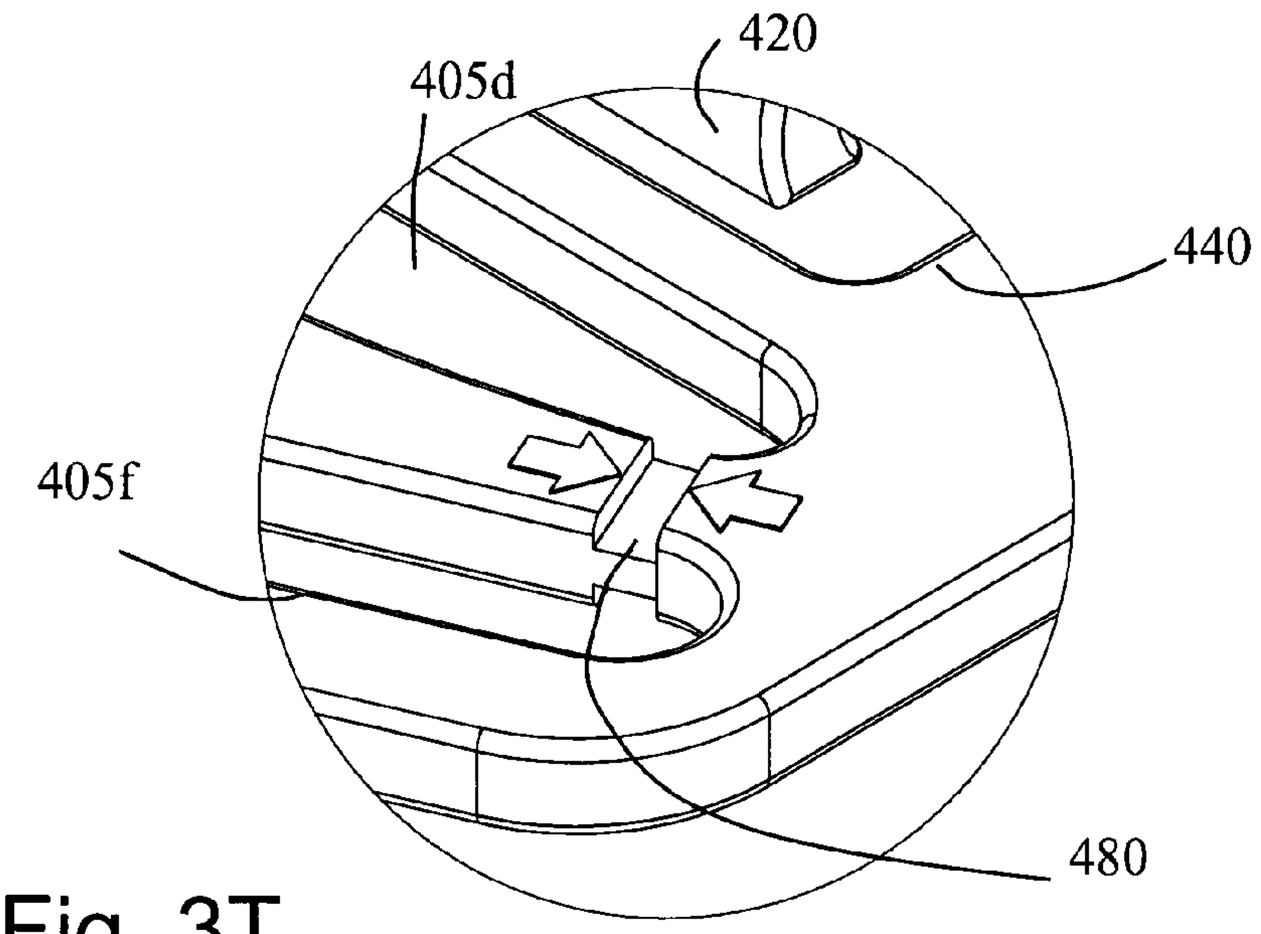
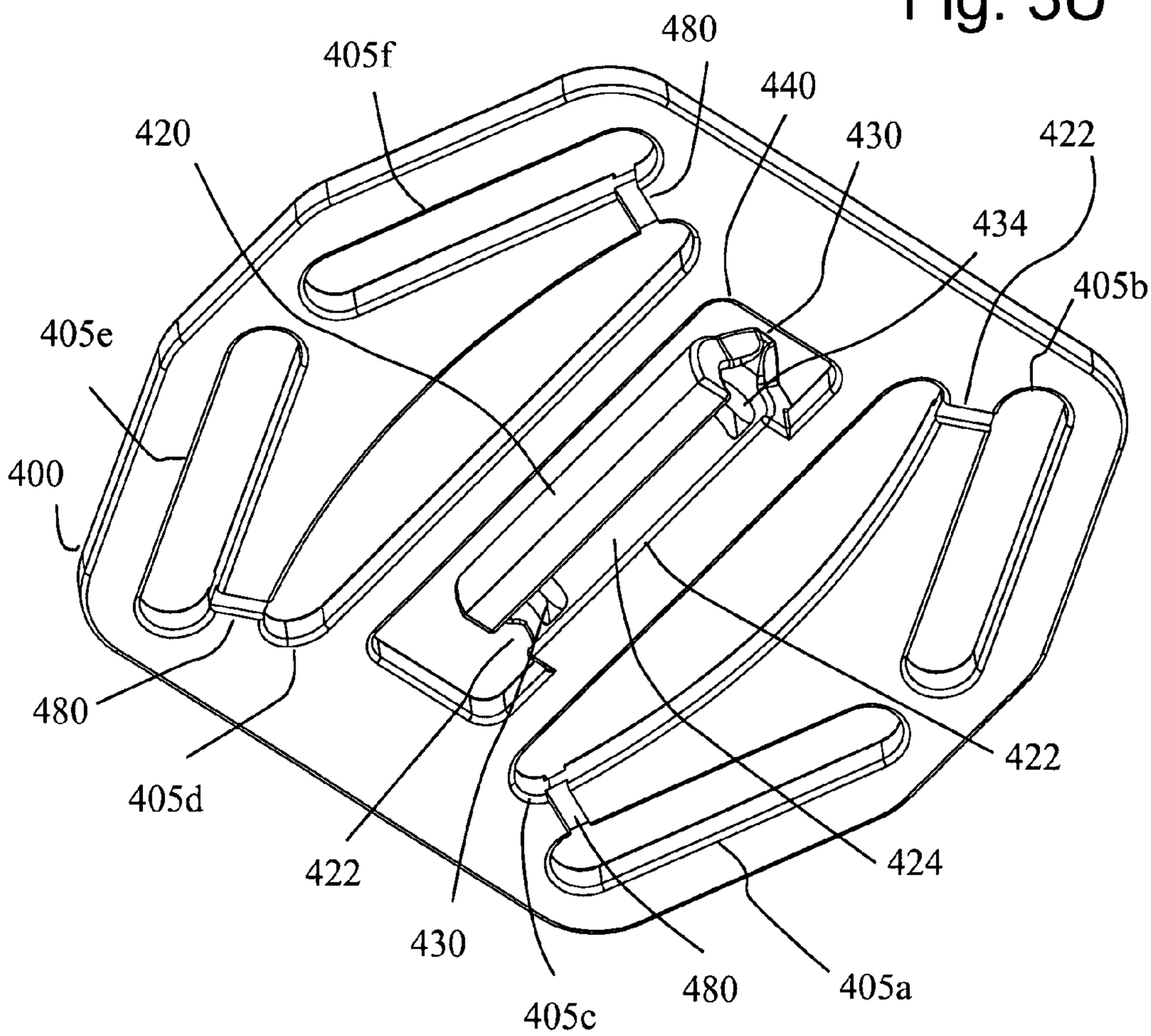


Fig. 3T

DETAIL A
Figure 3Q
SCALE 2 : 1

Fig. 3U



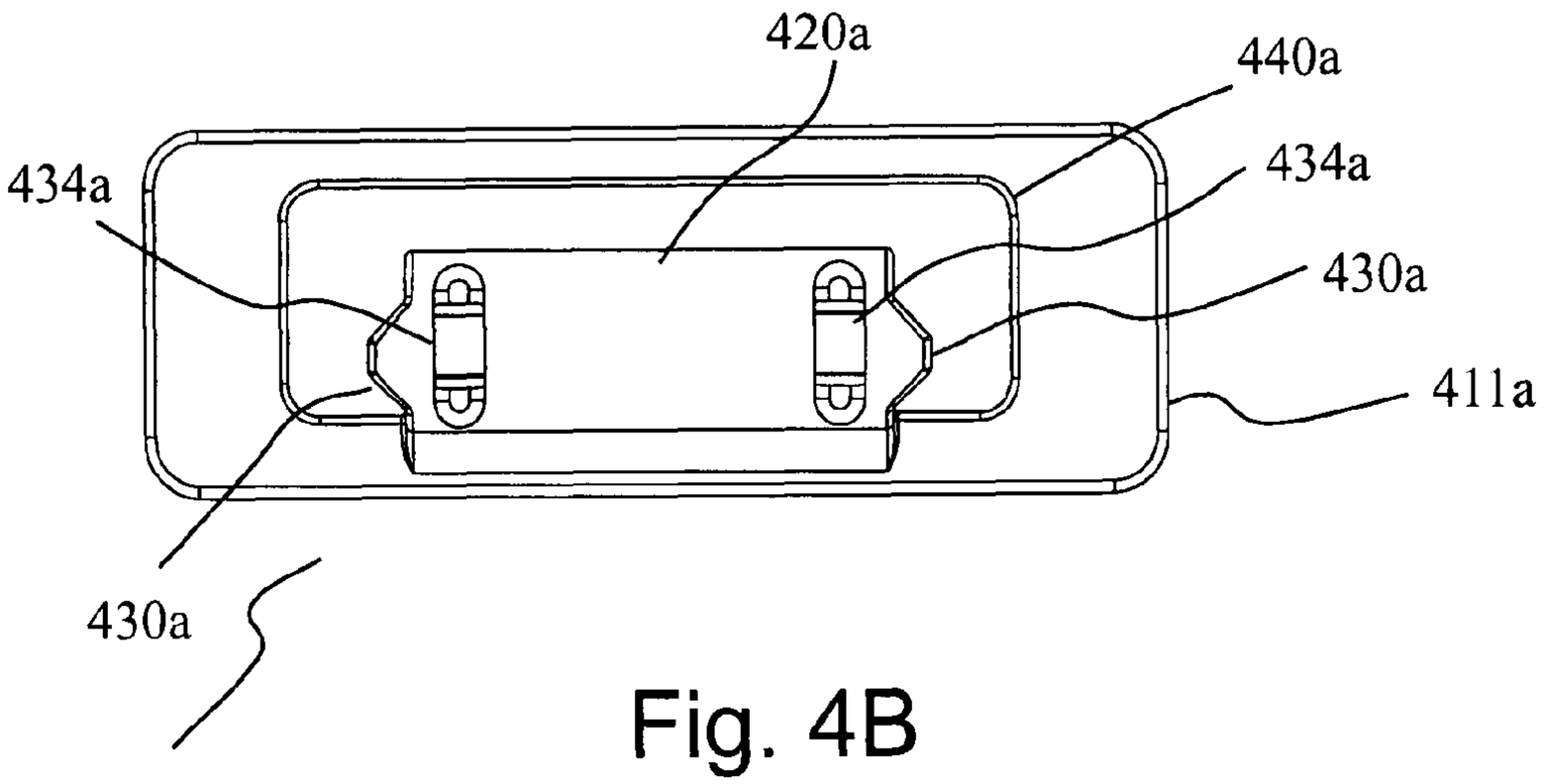

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Fig. 4B

Fig. 4A

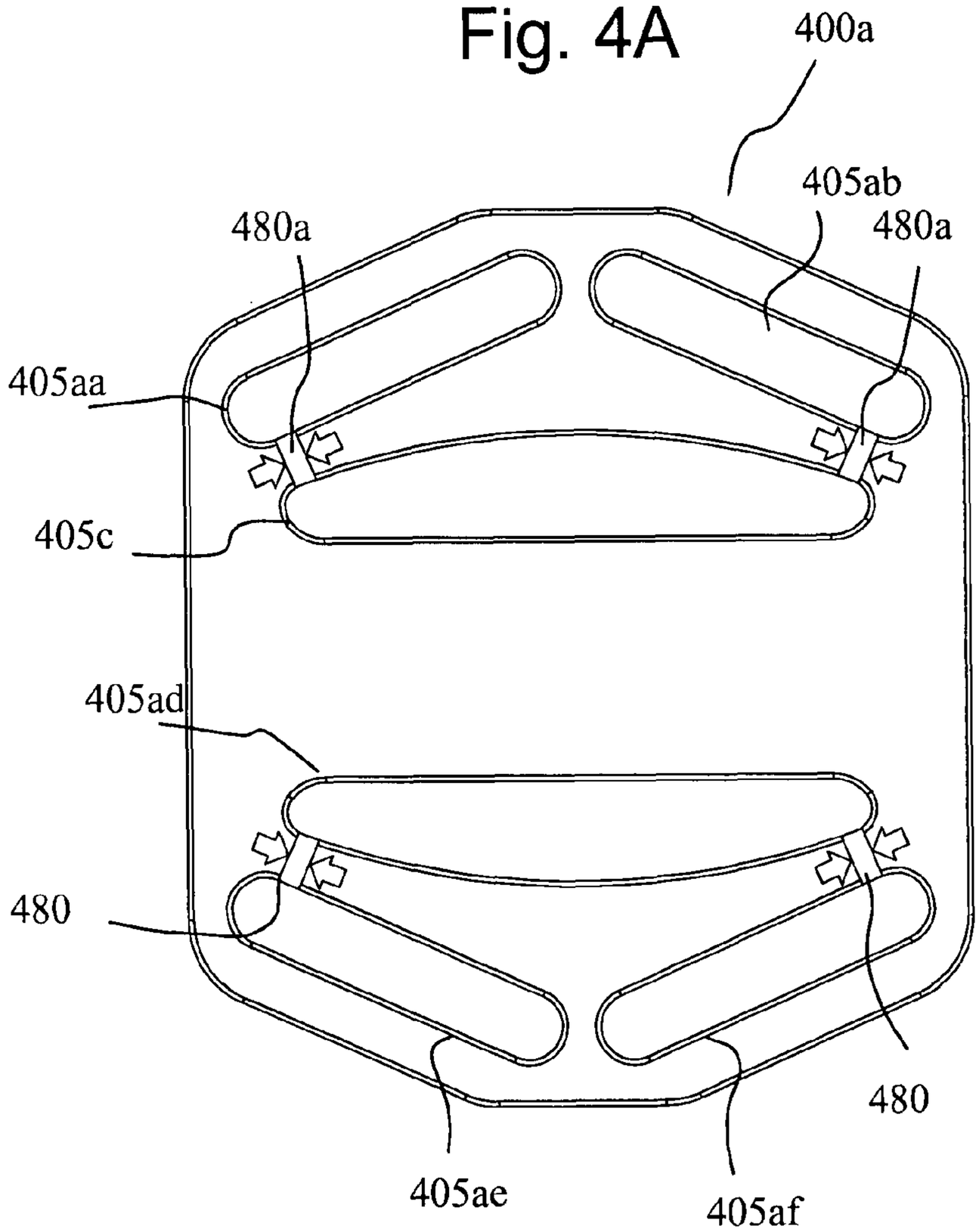
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Fig. 4C

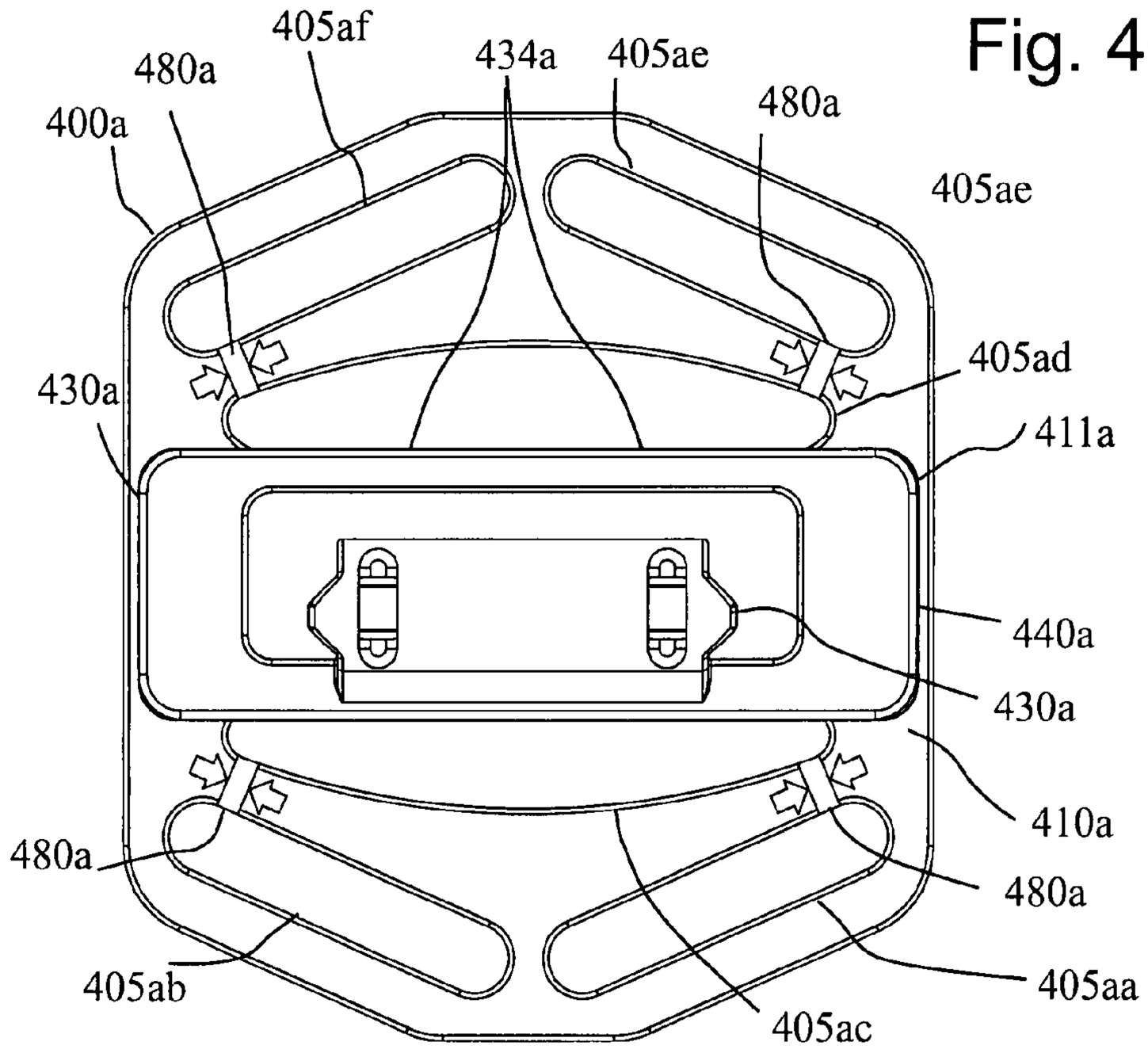
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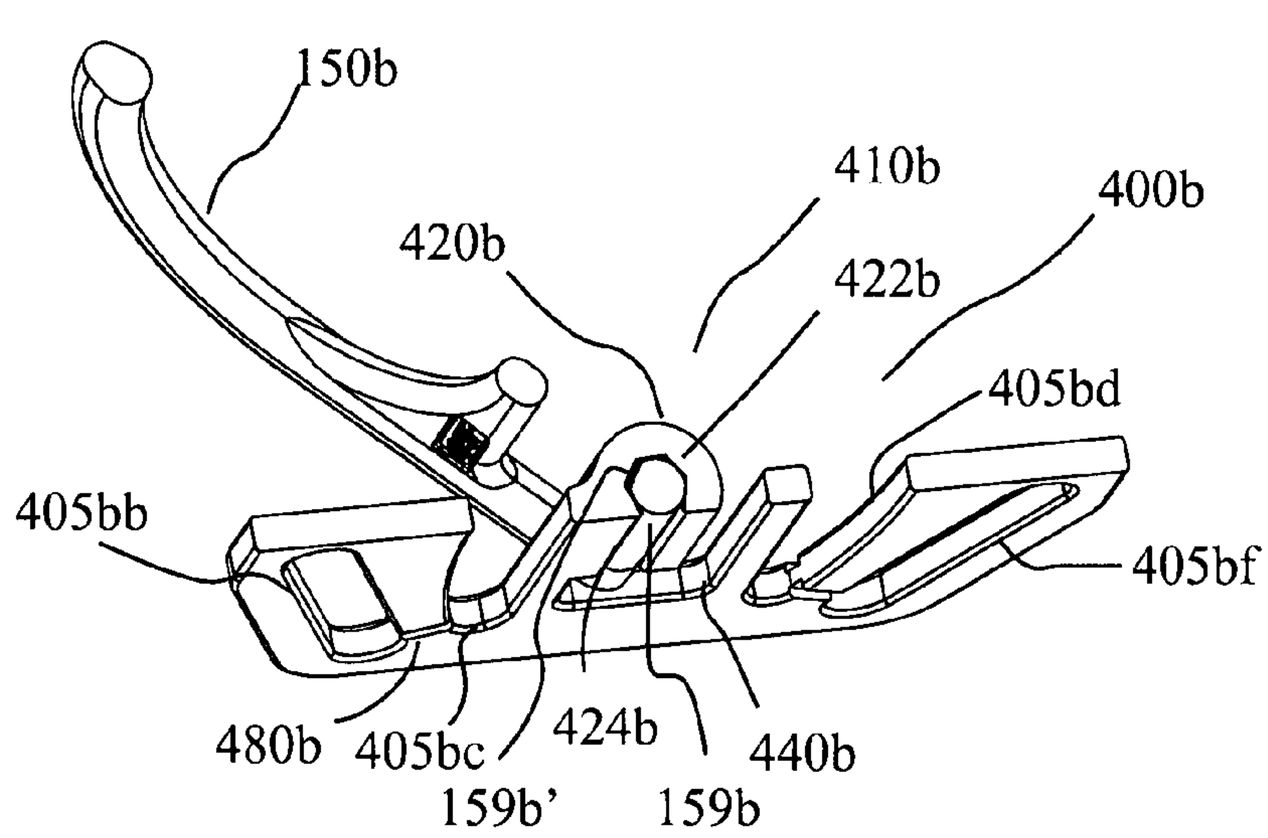
Fig. 5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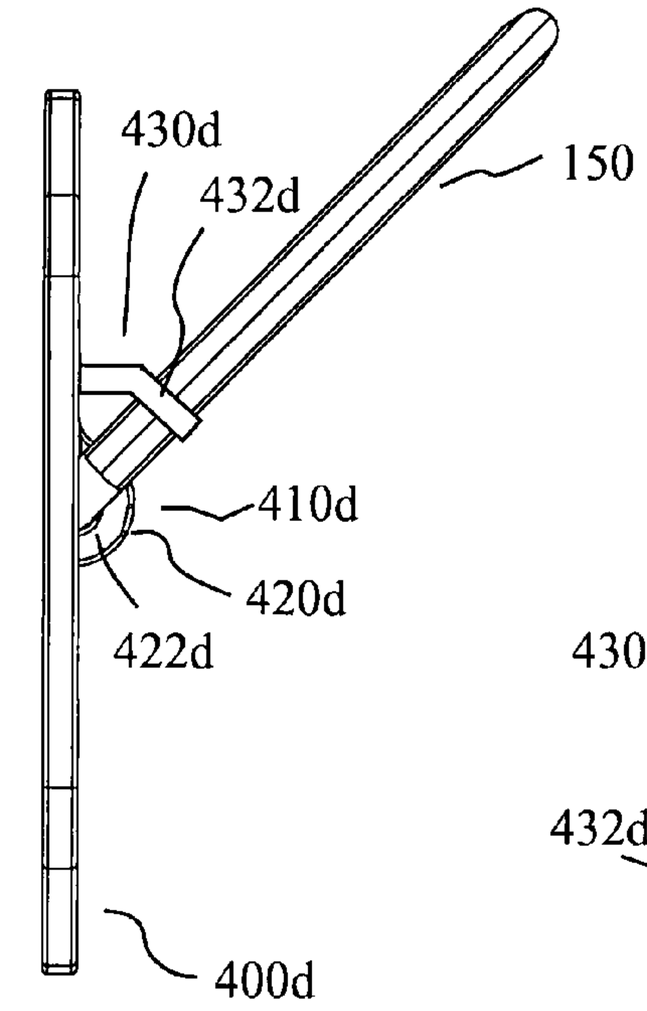
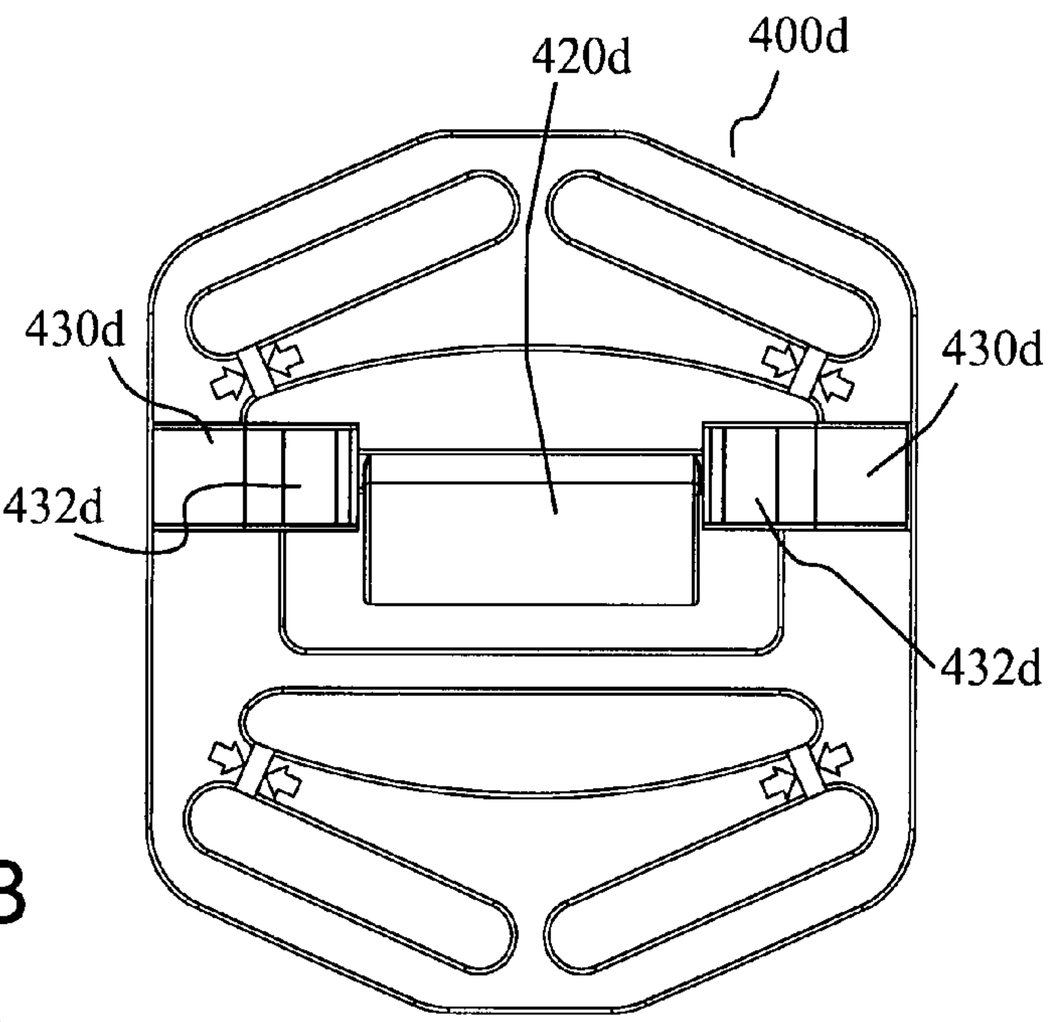


Fig. 6A



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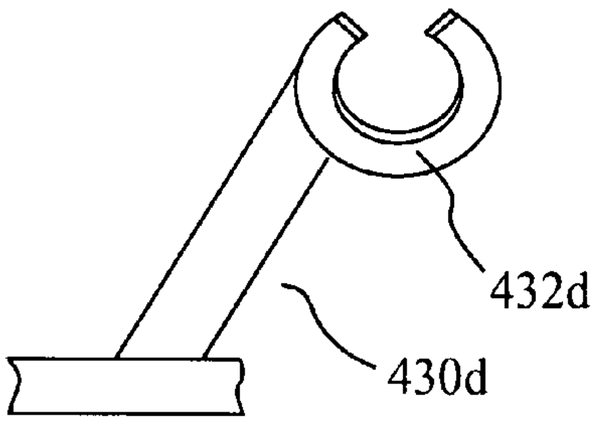


Fig. 6B

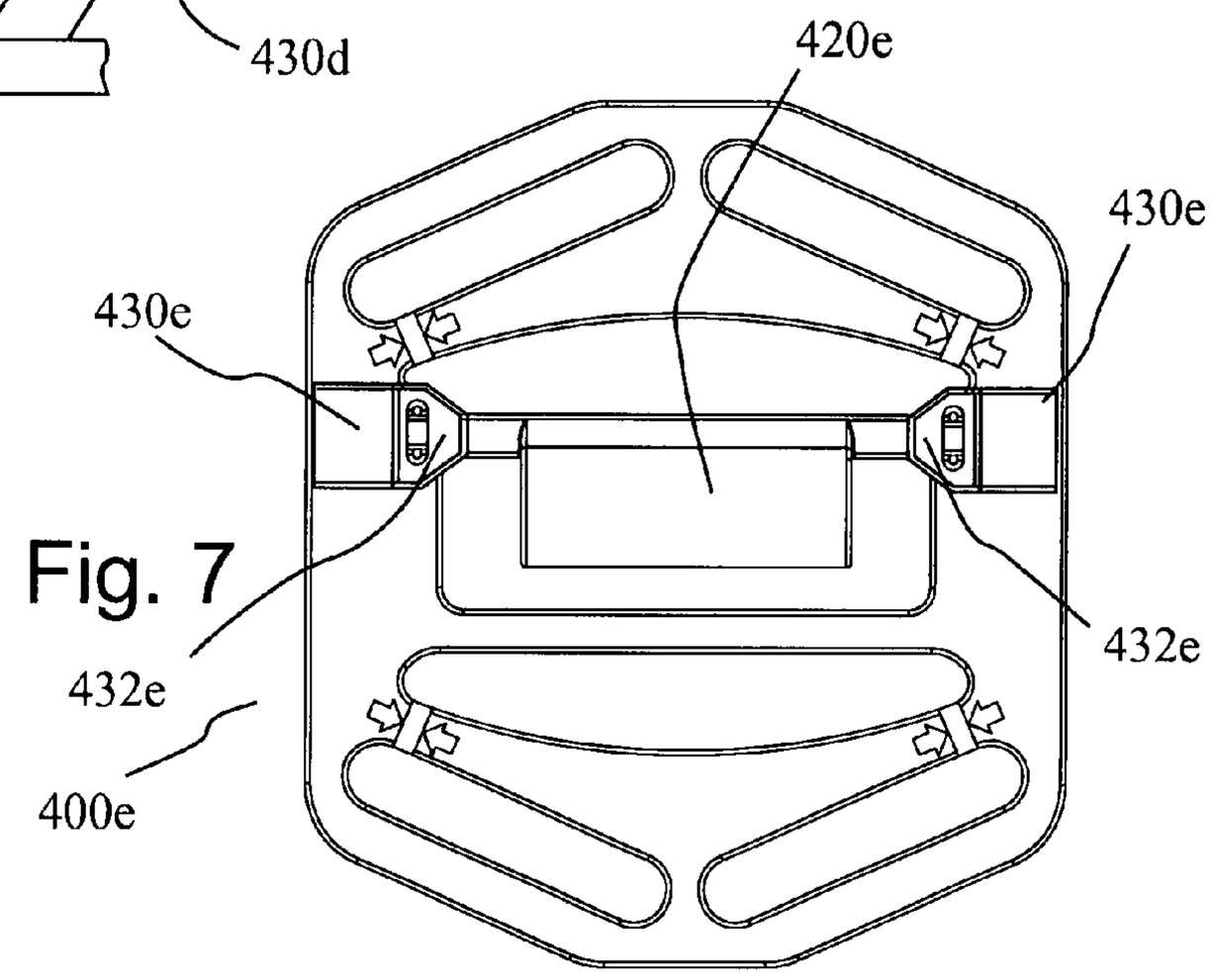
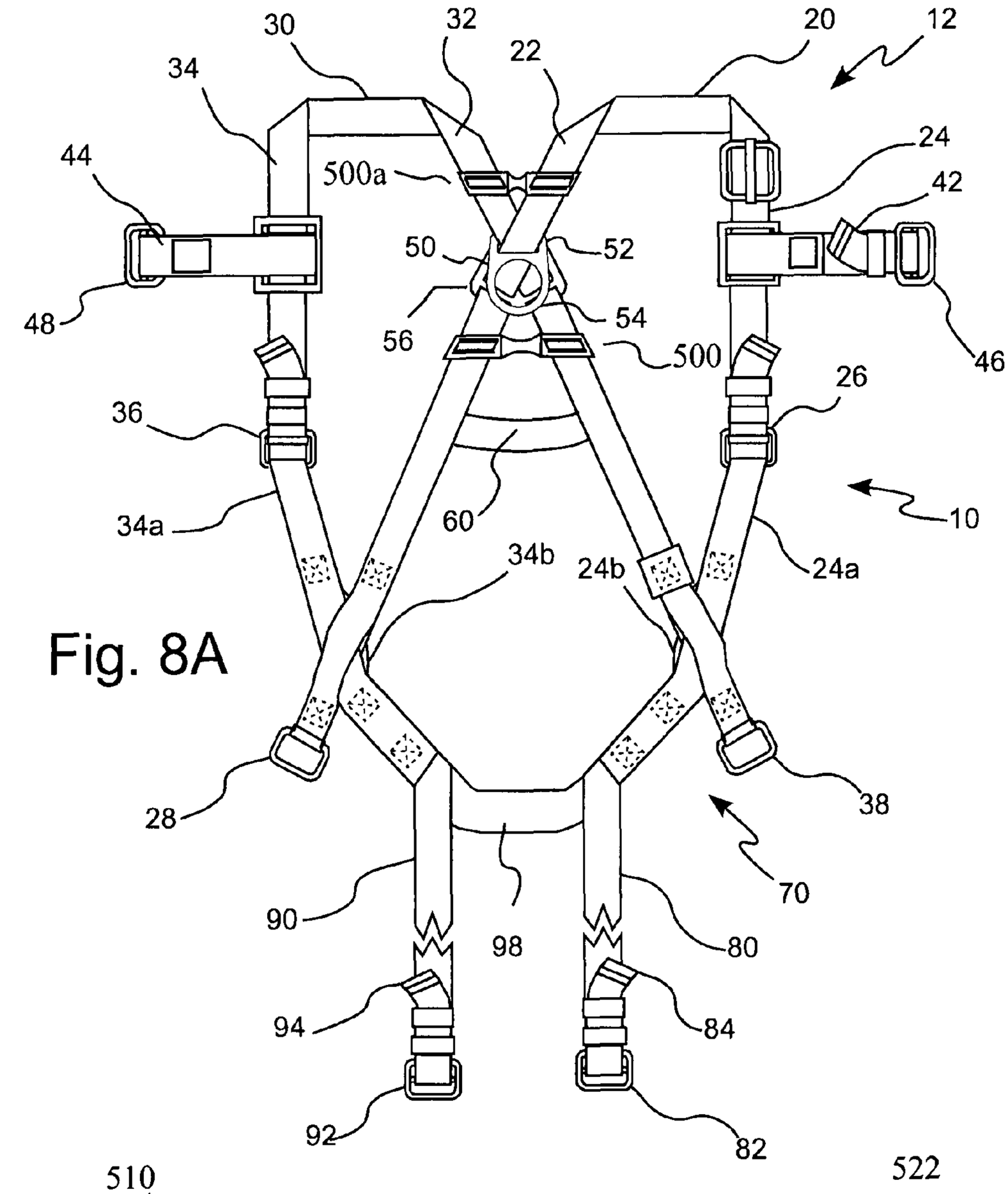


Fig. 7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34b
24b
28
38
70
90
98
80
94
84
92
82
510
522
530
512
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524
520
500

Fig. 8A

Fig. 8B

SAFETY HARNESSES, CONNECTIVE RING ATTACHMENTS FOR USE IN SAFETY HARNESSES AND BACK PADS FOR USE IN SAFETY HARNESSES

CROSS-REFERENCE TO RELATED APPLICATION

This application claims benefit of U.S. Patent Application Ser. No. 60/843,187,filed Sep. 8, 2007,the disclosure of which is incorporated herein by reference.

BACKGROUND OF THE INVENTION

The present invention relates generally to safety harnesses, and particularly to full body safety harnesses which, for example, provide ease of attachment of, for example, a safety lanyard or self retracting lanyard to a D-ring or other connective ring attached to the safety harness and/or provide a readily detectible indication that the safety harness has been subjected to a significant force (for example, as in an impact or in a fall).

The following information is provided to assist the reader in understanding the invention disclosed below and the environment in which it will typically be used. The terms used herein are not intended to be limited to any particular narrow interpretation unless clearly stated otherwise in this document. References set forth herein may facilitate understanding of the present invention or the background of the present invention. The disclosure of all references cited herein are incorporated by reference.

Safety harnesses are commonly used as part of a fall protection system for persons subjected to the potential of a fall from a height. In the workplace, full-body safety harnesses are required when working at a height of six feet or greater. Such harnesses, which typically include both an upper torso portion (having, for example, shoulder straps) and a lower torso or seat portion (having, for example one or more leg straps and sometimes a seat strap), can be designed in many alternative manners.

FIG. **1** illustrates an embodiment of a conventional, commercially available full-body safety harness **10** Safety harness **10** includes an upper torso portion **12** comprising first and second shoulder straps **20** and **30**, respectively, for extending over the shoulders of the user and a multi-component chest strap **40** for extending over a portion of the chest of the user.

A first end of each of shoulder straps **20** and **30** extends down over the back of the user to form first and second generally longitudinal back straps **22** and **32**, respectively. Longitudinal back straps **22** and **32** of shoulder straps **20** and **30** cross through and connect to a typical connector such as a D-ring **50** as known in the art. D-ring **50** includes a harness connection portion **52** and an anchor portion **54**. Harness connection portion **52** enables fastening of D-ring **50** to safety harness **10** via longitudinal back straps **22** and **32**. Anchor portion **54** is adapted to be connected to a nylon rope, a chain, webbing or other connector which may be used to anchor the person wearing safety harness **10**. Safety harness **10** includes a rear pad or back pad **56** that functions to guide the rear strap portions of the shoulder straps in a crossing fashion over the back of the user in the vicinity of D-ring **50**.

After crossing and passing through D-ring **50**, shoulder straps **20** and **30** are connected via a generally latitudinal back strap **60**. Latitudinal back strap **60** passes generally latitudinally over a portion of the back of the user.

A second end of each of shoulder straps **20** and **30** extends downward over the front of the user to from generally longitudinal first and second front straps **24** and **34**, respectively. A first chest strap portion **42** is attached to front strap **24** and a second chest strap portion **44** is attached to front strap **34**. Each of first and second chest straps **42** and **44** have cooperating fastening members **46** and **48** on the ends thereof to enable attachment of first and second chest straps **42** and **44** to form chest strap **40**. As known in the art, first and second chest straps **42** and **44**, respectively, are preferably attached via an adjustable mating friction buckle mechanism, including, for example, cooperating fastening members **46** and **48**.

First and second front straps **24** and **34** of shoulder straps **20** and **30**, respectively, extend further downward and preferably include adjustment members **26** and **36** (for example, adjustable friction buckles) as known in the art for adjustment of the fit of safety harness **10** on the upper torso of the user. Extending still further downward, extensions **24***a* and **34***a* of first and second front straps **24** and **34** converge and, in connection with several other components of safety harness **10** as described below, form a lower torso, seat or subpelvic portion **70**. First and second front extension straps **24***a* and **34***a* connect at section **98**, passing to the rear and under the seat of the user.

Attached to and extending from seat portion **70** are a first and a second leg strap **80** and **90**, respectively. Each of first and second leg straps **80** and **90** pass around the upper leg of the user to be attached to the distal end of first and second longitudinal back straps **22** and **32**, respectively. The distal ends of each of first and second leg straps **80** and **90** and the distal ends of each of longitudinal back straps **22** and **32** thus preferably comprise cooperating fastening members (**82** and **92** and **28** and **38**, respectively) such as adjusting buckle members as known in the art.

As in most commercially available harnesses, anchor portion **54** of D-ring **50** hangs downward as a result of the force of gravity after a harness is donned by the user. This position of D-ring **50** causes a significant amount of difficulty in attaching, for example, a snap hook (not shown) on the end of a lanyard (not shown) to D-ring **50** once harness **10** has been donned. Indeed, the wearer of a safety harness such as safety harness **10** often has to have another person connect such a snap hook (or other lanyard connector) to D-ring **50**.

U.S. Pat. No. 7,073,627 and Published U.S. Patent Application No. US2005/0082114 disclose a spring-loaded mechanism that constantly biases or urges a D-ring to an upright (or standup) position to facilitate attachment of a snap hook or other connector to the D-ring. The spring-loaded mechanism of U.S. Pat. No. 7,073,627 and Published U.S. Patent Application No. US2005/0082114 can be somewhat costly to manufacture. Moreover, moving parts such as spring can sometime become disconnected with the remainder of the assembly or fail during use.

It is often desirable that a safety harness also be provided with a means of providing an indication that the safety harness has been subjected to a significant force or impact (such as occurs during an impact or a fall). In that regard, a safety harness or a lanyard that has been subjected to such a force should be taken out of service. U.S. Pat. No. 4,253,544,for example, discloses a lanyard in which stress of a fall causes breakage of stitching and the release of a flag as an indicator. U.S. Pat. No. 6,006,860 discloses a safety harness in which visible rupture of stands of fabric in a harness webbing provides an indication of a fall.

U.S. Pat. No. 7,073,627 and Published U.S. Patent Application No. US2005/0082114 disclose a dorsal pad assembly that includes a D-ring connector portion in which the D-ring

is urged to an upright position as described above. The dorsal pad assembly of U.S. Pat. No. 7,073,627 and Published U.S. Patent Application No. US2005/0082114 can also include an impact indicator in the form of a clip to which D-ring is operatively connected. In the case of a fall, the D-ring snaps out of the D-ring clip/indicator by deflecting catches built into the D-ring clip/indicator, thereby indicating that a force has been applied to the D-ring. A bar portion of the D-ring can also include a colored portion or an ink cartridge that is broken that becomes exposed when the D-ring snaps out of the clip. Alternate embodiments of the dorsal pad assembly of U.S. Pat. No. 7,073,627 and Published U.S. Patent Application No. US2005/0082114 disclose impact indicators in the form of a wear pad and/or wear pad frame, or a D-ring bar engaging device, operatively connected to the D-ring. In the case of a fall, the D-ring is moved relative to the wear pad and/or wear pad frame, or the bar engaging device, thus breaking rivets, breaking an ink cartridge, exposing a colored portion of the D-ring or deflecting tabs, thereby indicating a force has been applied to the D-ring. U.S. Pat. No. 7,073,627 and Published Patent No. US2005/0082114 disclose a further alternate embodiment of an impact indicator in the form of a clip that holds the D-ring in a certain position wherein the D-ring is pulled out of the clip in the case of a fall, thereby indicating that a force has been applied to the D-ring.

It is also well known that all portions of the safety harness should be inspected for signs of an impact or fall. It is, for example, well know that back pads used in connection with safety harnesses can distend or otherwise change in appearance and sometimes break in the case of a fall. For example, the User Instructions provided with the Full Body Tiger Harness available from Rose Manufacturing Company, indicate that the D-ring locator pad or back pad should be inspected for a change in appearance (for example, breakage) providing evidence of a fall.

Although a number of fall and/or impact indicators have been provided in a number of harnesses, such indicators can increase the manufacturing time and cost involved in assembly of the harness. This problem is particularly relevant to indicators that include or are part of assemblies of multiple elements. Moreover, such multi-element assemblies can sometimes fail.

It is very desirable to develop improved safety harnesses and elements or components thereof that reduce or eliminate the above and other problems with currently available harnesses.

SUMMARY OF THE INVENTION

In one aspect, the present invention provides a back pad system for use in connection with a safety harness. The safety harness includes at least two spaced back straps and a connector adapted to be connected to a line or lanyard. The back pad system includes a back pad including passages (for example, at least two passages) through which the two back straps can be passed to be crossed over the connector. The back pad system also includes an attachment to which the connector can be moveably attached. The back pad system further includes at least one member that captures, maintains or holds the connector in an upright position upon application of force (either directly or indirectly—for example, manual force) to the connector to move the connector to the upright position.

The connector attachment can include a seating adapted to seat the connector so that the connector is rotatable relative to the connector attachment to the upright position. The at least one capture member can, for example, be attached to a side of the back pad. The at least one capture member can also, for example, include a detent on a lateral side of the connector attachment that is adapted to capture the connector in the upright position. In one embodiment, the connector attachment includes a first detent on a first lateral side of the connector attachment and a second detent on a second lateral side of the connector attachment. The first detent and the second detent are adapted to capture the connector in the upright position. The connector can, for example, be a D-ring comprising a bottom bar that fits within the seating of the connector attachment.

The back pad can further include at least one load indicator including an area of reduced strength in the back pad so that the area visibly distends or breaks upon the safety harness being subjected to a substantial load. As clear to one skilled in the art, the load can readily be predetermined. The substantial load can, for example, be at least approximately 450 pounds of force.

In several embodiments back pad systems of the present invention, the connector attachment and the capture member(s) are attached to the back pad. The back pad, the connector attachment and the capture member(s) can, for example, be formed monolithically. In one such embodiment, the at least one capture member includes a detent on a lateral side of the connector attachment that is adapted to capture the connector in the upright position. In another such embodiment, the connector attachment includes a first detent on a first lateral side of the connector attachment and a second detent on a second lateral side of the connector attachment. The first detent and the second detent are adapted to capture the connector in the upright position.

The connector attachment and/or capture members can also be formed separately from the back pad and not be attached to the back pad.

In another aspect, the present invention provides a connector attachment for use in connection with a safety harness including at least two spaced back straps and a connector adapted to be connected to a line or lanyard. The connector attachment includes at least one member that captures the connector in an upright position upon application of force (either directly or indirectly) to the connector to move the connector to the upright position and a seating adapted to seat the connector so that the connector is rotatable relative to the connector attachment to the upright position.

The connector attachment can, for example, include a first detent on a first lateral side of the connector attachment and a second detent on a second lateral side of the connector attachment. The first detent and the second detent are adapted to capture the connector in the upright position. The connector can, for example, be a D-ring including a bottom bar that fits within the seating of the connector attachment.

In another aspect, the present invention provides a back pad for use in connection with a safety harness including at least two spaced back straps and a connector adapted to be connected to a line or lanyard. The back pad includes a base comprising passages through which the two back straps can be passed to be crossed over the connector. The back pad further includes at least one load indicator. The load indicator includes an area of reduced strength in the base so that the area visibly distends or breaks upon the safety harness being subjected to a substantial load. The substantial load can, for example, be predetermined to be at least approximately 450 pounds of force. The area of reduced strength can, for example, be an area of reduced thickness. The back pad can, for example, include a plurality of areas of reduced thickness.

In one embodiment, the pack pad includes a first upper slot, a second upper slot, a central upper slot, a central lower slot,

a first lower slot and a second lower slot. The back pad can also include a first area of reduced thickness between the first upper slot and the central upper slot, a second area of reduced thickness between the second upper slot and the central upper slot, a third area of reduced thickness between the first lower slot and the central lower slot and a fourth area of reduce thickness between the second lower slot and the central lower slot.

In another aspect, the present invention provides a safety harness including a connector adapted to be connected to a line or lanyard, an attachment to which the connector can be moveably attached, and at least one member that captures the connector in an upright position upon application of force (either directly or indirectly) to the connector to move the connector to the upright position.

In a further aspect, the present invention provides a safety harness including at least two spaced back straps, a connector adapted to be connected to a line or lanyard. The safety harness further includes a back pad system including a back pad including passages (for example, at least two passages) through which the two back straps can be passed to be crossed over the connector, an attachment to which the connector can be moveably attached, and at least one member that captures the connector in an upright position upon application of manual force (either directly or indirectly) to the connector to move the connector to the upright position.

In another aspect, the present invention provides a safety harness including at least two spaced back straps and a connector adapted to be connected to a line or lanyard. The safety harness further includes a back pad including a base including passages through which the two back straps can be passed to be crossed over the connector and at least one load indicator. The load indicator includes an area of reduced strength in the base so that the area visibly distends or breaks upon the safety harness being subjected for a substantial load. The area of reduced strength (as compared to other portions of or the remainder of the back pad) is purposefully created (for example, during manufacture of the back pad).

In still a further aspect, the present invention provides a load indicator for use in connection with a safety harness comprising at least two spaced straps. The load indicator provides a visible indication that the safety harness has been subjected to a substantial load. The load indicator includes at least a first connector and a second connector in connection with the first connector. The first connector is adapted to connect to the first strap and the second connector is adapted to connect to the second strap. A change in force exerted on the load indicator by the first strap and the second strap when the safety harness is subjected to the substantial load causes the load indicator to change in appearance.

The first connector can, for example, include at least a one passage through which the first strap passes, and the second connector can include at least one passage through with the second strap passes. The change in appearance of the load indicator can, for example, be a distention or breaking of at least a potion of the load indicator. The change in force exerted on the load indicator can, for example, at least in part, be caused by relative movement between the load indicator and the first and second straps. In several embodiments, the load indicator is adapted to be positioned in proximity to an area where the first strap and the second strap cross (for example, adjacent to or spaced from a back pad through which the straps cross). The load indicator can, for example, form a back pad through which the first strap and the second strap are crossed.

The present invention, along with the attributes and attendant advantages thereof, will best be appreciated and understood in view of the following detailed description taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** illustrates an embodiment of a commercially available safety harness.

FIG. **2**A illustrates a perspective view of an embodiment of a harness of the present invention in a form as donned by a user.

FIG. **2**B illustrates a perspective view of a portion of the safety harness of FIG. **2**A including a back pad of the present invention.

FIG. **2**C illustrates a rearward view of an embodiment of a D-ring for use in connection with the harness of FIG. **2**A.

FIG. **2**D illustrates a rear view of the back pad portion of the harness of FIG. **2**A.

FIG. **3**A illustrates a rearward perspective view an embodiment of a back pad of the present invention for use in connection with the harness of FIG. **2**A wherein the D-ring is captured in an upright position.

FIG. **3**B illustrates a forward perspective view the back pad of FIG. **3**A wherein the D-ring is captured in an upright position.

FIG. **3**C illustrates a rearward view the back pad of FIG. **3**A wherein the D-ring is captured in a non-upright or downward position.

FIG. **3**D illustrates a rearward, enlarged perspective view of a portion of the back pad of FIG. **3**A wherein the D-ring is captured in an upright position.

FIG. **3**E illustrates the rearward, enlarged perspective view of FIG. **3**D wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **3**F illustrates another rearward, enlarged perspective view of the back pad of FIG. **3**A wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **3**G illustrates a perspective cutaway view of the back pad of FIG. **3**A wherein the D-ring is in an upright position.

FIG. **3**H illustrates a side view of the back pad of FIG. **3**A wherein the D-ring is in an upright position.

FIG. **3**I illustrates a rearward view of the back pad of FIG. **3**A wherein the D-ring is in an upright position.

FIG. **3**J illustrates another rearward perspective view of the back pad of FIG. **3**A wherein the D-ring is in an upright position.

FIG. **3**K illustrates a top view of the back pad of FIG. **3**A wherein the D-ring is in an upright position.

FIG. **3**L illustrates another forward perspective view of the back pad of FIG. **3**A wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **3**M illustrates an enlarged, rearward perspective view of a portion of the back pad of FIG. **3**A illustrating an area of decreased thickness in the back pad to create a stress point to provide a visual indication in the case that the safety harness in connection with which the back pad is used is subjected to a relatively large force or load as would occur in an impact or a fall.

FIG. **3**N illustrates another rearward perspective view of the back pad of FIG. **3**A wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **3**O illustrates a side view of the back pad of FIG. **3**A wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **3**P illustrates a top view of the back pad of FIG. **3**A wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **3**Q illustrates a rearward perspective view of the back pad of FIG. **3**A wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **3**R illustrates another rearward perspective side view of the back pad of FIG. **3**A wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **3**S illustrates a forward view of the back pad of FIG. **3**A wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **3**T illustrates another enlarged, rearward perspective view of a portion of the back pad of FIG. **3**A (encircled in FIG. **3**Q) illustrating an area of decreased thickness in the back pad to create a stress point to provide a visual indication in the case that the safety harness in connection with which the back pad is used is subjected to a relatively large force or load as would occur in an impact or a fall.

FIG. **3**U illustrates another rearward perspective side view of the back pad of FIG. **3**A wherein the D-ring has been removed from connection with the D-ring attachment of the back pad.

FIG. **4**A illustrates a rearward view of a hexagonal back pad providing an embodiment of a load indicator of the present invention.

FIG. **4**B illustrates a rearward view of a D-ring attachment of the present invention that can be use in connection with the back bad of FIG. **4**A.

FIG. **4**C illustrates a rearward view of the D-ring attachment of FIG. **4**B in position for use with the back bad of FIG. **4**A.

FIG. **5** illustrates a perspective cutaway view of another embodiment of a back pad of the present invention including a D-ring attachment including a D-ring seating of noncircular cross-section.

FIG. **6**A illustrates a side view another embodiment a back pad of the present invention including capture members to hold a D-ring in an upright position.

FIG. **6**B illustrates an enlarged bottom view of one of the capture members of the back pad of FIG. **6**A.

FIG. **6**C illustrates a rearward view of the back pad of FIG. **6**A with the D-ring removed from connection therewith.

FIG. **7** illustrates a rearward view of another embodiment of a back pad of the present invention including a capture member having flexing detents to hold a D-ring in an upright position in which the D-ring is removed from connection with the back pad.

FIG. **8**A illustrates the safety harness of FIG. **1** including two examples of another embodiment of a load indicator of the present invention.

FIG. **8**B illustrates a rear view of one of the load indicators of FIG. **8**A.

DETAILED DESCRIPTION OF THE INVENTION

FIGS. **2**A and **2**B illustrate one embodiment of a full body safety harness **100** of the present invention. Various general aspects of safety harness **100** are disclosed in Published U.S. Patent Application Nos. 2006/0005293 and 2006/0102423, assigned to the assignee of the present invention. Safety harness **100** includes an upper torso section, portion or module **110** and a lower torso or seat section, portion or module **112**. Upper torso portion **110** includes a first shoulder strap **120** and a second shoulder strap **130** extending over the shoulders of the user and a multi-component chest strap **140** extending between first shoulder strap **120** and second shoulder strap **130**. First ends of each of shoulder straps **120** and **130** extend down over the back of the user to form first and second generally longitudinal back straps **122** and **132**, respectively. Back straps **122** and **132** cross through an opening **153** in D-ring **150** and thereby are connected to D-ring **150**. In the area of D-ring, back straps **122** and **132** also cross through a back pad **200** (see FIG. **2**B) in the region of D-ring **150**. Back pad **200** is described further below. Back straps **122** and **132** are attached at their respective ends to right side and left side connectors **300**, that operate to connect upper torso portion or module **110** to lower seat portion or module **112** such that upper torso portion **110** is relatively easily rotated relative to lower seat portion **112**. Back straps **122** and **132** can, for example, be looped around slots formed in connectors **1900** and stitched.

As used herein terms such as "left", "right", "side", "front", "back", "up", "down", "reward", "forward", "top", "bottom" and similar terms when used to refer to harness **100** or any portion thereof (including a back pad or back pad system **400** as described below) refer to a direction relative to the orientation of harness **100** (or a portion thereof) when harness **100** is donned or worn by a user as illustrated in FIG. **2**A. Such designations are provided for ease of reference and are not to be construed as limiting the present invention to any particular embodiment unless specifically set forth otherwise.

A second end of each of shoulder straps **120** and **130** extends downward over the front of the user to form generally longitudinal first and second front straps **124** and **134**, respectively. Chest strap **140** is attached between front strap **124** and front strap **134** of shoulder straps **120** and **130**, respectively. One or more adjustable adjustment mechanism can be provided to adjust the length of chest strap **140**.

First and second front straps **124** and **134** extend further downward from chest strap **140** and terminate at and are attached to a cam buckle adjustment mechanisms **126** and **136**, respectively, or other adjustment mechanism for adjustment of the fit of safety harness **100** on the upper torso of the user. Lengths of connecting strapping strap **124'** and **134'** are connected at a first end thereof to cam buckles **100** and at a second end thereof to connectors **300**. In that regard, straps **124'** and **134'** can, for example, be looped through slots formed in connectors **300**.

Lower torso or seat portion **112** of safety harness **100** can, for example, include leg straps **180** and **190**. Leg strap **180** can be attached to right side connector **300** at a first or front end thereof via a slot formed therein. A second or rearward end of leg strap **180** is attached to seat strap **170**. Seat strap **170** is attached at a first end thereof to right side connector **300** via a slot formed therein. Similarly, leg strap **190** is attached to left side connector **300** at a first or front end thereof via a slot formed therein. A second or rearward end of leg strap **190** is attached to seat strap **170**. A second end of seat strap **170** is attached to left side connector **300** via a slot formed therein. Leg straps **180***a* and **190***a* can include adjustment members or mechanisms.

As illustrated in FIG. **2**B, D-ring **150** and back pad or back pad system **400** are positioned over an intermediate section of comfort pad **600** between a meshed section **620** and shield section **640** of comfort pad **600**, which are described in detail, for example, in Published U.S. Patent Application No. 2006/0102423,the disclosure of which is incorporated herein by reference. In the illustrated embodiment, back pad **400** is not attached to comfort pad **600**. As known in the art, back pad **400** includes six slots **405***a-f* through which straps **122** and **132** cross and pass through a channel **154** (see FIGS. **2**B through **2**D) of D-ring **150**. In the illustrated embodiment, there is a first or left upper slot **405***a*, a second or right upper slot **405***b*, and generally central upper slot **405***c*, a generally central lower slot **405***d*, a first or left lower slot **405***d* and a

second or right lower slot **405***e*. A connector such as a snap hook (not shown) can be connected to anchor attachment portion **158** of D-ring **150**.

As illustrated, for example, in FIGS. **3**A through **3**U, back pad **400** can include a D-ring attachment **410** in which D-ring **150** is movably (for example, rotatably or pivotably) seated or attached. Upon application of direct or indirect force (for example, manual force) to D-ring **150** to move D-ring **150** to an upright position, D-ring **150** is captured, held or maintained in the upright position. Neither attachment **410** nor any other element of back pad **400** urges or biases D-ring **150** into an upright position. However, D-ring **150** is captured, held or maintained in an upright position when D-ring is moved to that position via application of force thereto. Extra components associated with a biasing or urging mechanism (for example, springs) are thereby eliminated.

In the illustrated embodiment, D-ring attachment **410** includes a generally cylindrical central portion **420** including a generally cylindrical passage **422** therethrough in which a lower bar or connecting member **159** of D-ring **150** is positioned or seated. In that regard, during attachment of D-ring **150** to attachment **410**, bar **159** is first passed through an opening **440** formed in back pad **400**. Bar **159** is then aligned with an extending opening or slot **424** formed on a forward side (with respect to the orientation of back pad **400** when worn by a user) of central portion **410**. Slot **424** is in operative connection with passage **422** and extends along the entire length of central portion **420**. Once bar **159** is aligned with slot **424**, a rearward force (with respect to the orientation of back pad **400** when worn by a user) is applied to D-ring **150** so that bar **159** is snapped into place within passage **422**.

Bar **159** can be rotated within passage **422**. D-ring **150** is illustrated in a downward position in FIG. **3**C. When force is applied to D-ring **150** to move D-ring toward and upright position (illustrated, for example, in FIGS. **3**A and **3**B), bar **159** rotates within passage **422**. A central wall of side members **153** of D-ring **150** contact one or more capture members, abutment members, extensions or detents **430** positioned, for example, on the lateral sides of central portion **420**. Detents **430** are forced laterally inward upon contact with side members **153**. Openings or expansion slots **434** can, for example, be provided in central portion **420** to facilitate the inward flexing of detents **430**. Once side members **153** pass detents **430** (that is, once D-ring **150** is moved into the upright position), detents **430** flex laterally outward to capture D-ring **150** in the upright position.

Straps **122** and **132** pass over central portion **420** of D-ring attachment **410** (and thereby through channel **154** of D-ring **150**) as illustrated, for example, in FIGS. **2**B and **2**D. In general, D-ring **150** abuts the rearward or outermost strap (see, for example, FIG. **3**H) of harness **100** after D-Ring is forced into the upright position such that D-ring is maintained within a range of angles (A) of the upright position (for example, between approximately 20° and approximately 45° with respect to a vertical orientation.

Entire back pad/back pad system **400** can, for example, be molded (for example, injection molded) monolithically from a polymeric material such as a thermoplastic polymeric material or a thermoplastic elastomer polymer/thermoplastic polymer blend (for example, a thermoplastic elastomer/polypropylene blend). Other suitable materials include flexible, semi-rigid polymeric materials such as various plastics, rubbers and polyurethanes. The are no components to assemble during manufacture or become disassembled during use. Moreover, there are no moving elements of back pad **400** to fail during use. A user can, for example, push D-ring **150** into the upright position before donning harness **100**. Once a snap hook or other connector has been attached to D-ring, the force of gravity will typically pull D-ring **150** into a non-upright, downward or natural position as, for example, illustrated in FIG. **3**C. To once again place D-ring **150** into an upright position (to, for example, remove a snap hook from connection therewith), a user or wearer of harness **100** can, for example, apply force to a line or lanyard connected to the snap hook to force D-ring **150** into an upright position. While maintaining force (for example, an upward force) on the line or the snap hook (or other connector) with one hand, the user can, for example, remove the snap hook from connection with D-ring **150** with the other hand of with the same hand.

Existing harnesses can be retrofitted to incorporate an upright D-ring mechanism the same as or similar to that illustrated in FIGS. **3**A through **3**U. In that regard, back pads in current use in commercially available safety harnesses can, for example, be replaced by back pad **400**. Moreover, existing safety harnesses and/or back pads for use therewith can be used in connection with a standalone D-ring/connector attachment of the present invention to, for example, from a back pad system similar in operation to back pad/back pad system **400**. For example, FIG. **4**A illustrates a hexagonal D-pad **400***a*. FIG. **4**B illustrates a separate or standalone upright D-ring attachment **410***a* of the present invention that is similar in operation to D-ring attachment **410**. D-ring attachment **410***a* includes a base **411***a* in which an opening **440***a*, similar in function to opening **440**, is formed. D-ring attachment **410***a* includes a central portion **420***a* that operates in an identical manner to central portion **420**. In general, components of D-ring attachment **410***a* are numbered similarly to corresponding or like components of D-ring attachment **410** with the addition of the designation "a". A connector attachment such as D-ring attachment **410** can be used in connection with generally any safety harness comprising a connector such as a D-ring, whether or not the safety harness includes a back pad as known in the art.

Other types of abutment or capture member can be used to capture D-ring **150** or another connector in an upright position to facilitate attachment of a connector such as a snap hook thereto. As illustrated, for example, in FIG. **5**, a back pad **400***b* can include a passage **422***b* in a central portion **420***b* of a D-ring attachment **410***b* having a noncircular cross-section over at least a portion thereof or over the entirety thereof. In the illustrated embodiment, passage **422***b* has a generally hexagonal cross-section. Lower bar **159***b* of D-ring **150***b* can have a flattened surface **159***b*' to facilitate positioning thereof in cooperation with noncircular passage **422***b*. In the illustrated embodiment, D-ring **150** can be placed in various positions including an upright or connecting position upon application of force (for example, manual force) to D-ring **150***b*.

Capture member or abutment members to capture or hold a D-ring such as D-ring **150** or other similar anchoring connector can also be positioned away from a D-ring attachment member. As illustrated in FIGS. **6**A through **6**C, back pad **400***d* includes an D-ring attachment **410***d* that operates similarly to D-ring attachment **410**. D-ring attachment does not include detents **430**, however. In that regard, capture members **430***d* are provided on each side of back pad **400** to capture and hold D-ring **150** in an upright position. In the embodiment illustrated in, FIGS. **6**A and **6**B, capture member **430***d* include a generally cylindrical seating **432***d* with which side member **153** of D-ring can form a snap fit upon application of force to D-ring **150** to move D-ring **150** in the upright position as illustrated in FIG. **6**A.

In the embodiment illustrated in FIG. **7**, a back pad **400***e* can be provided with capture members **430***e* that include

flexing detents **432***e* to hold D-ring **150** in an upright position upon a application of force to D-ring **150** to move D-ring **150** in the upright position.

In the case of application of a relatively large force to harness **10** (as, for example, in a fall), the force is transferred to straps **122** and **132** which pass over central portion **420** (or other central portion as described above) when harness **100** is assembled. Under a substantial load, straps **122** and **132** become taut, changing the force exerted upon, for example, back pad **400** (or another back pad or other load indicator of the present invention as described below). Further, back pad **400** is movable relative to straps **122** and **132**. Indeed, such movability provides users of various heights and weights with the ability to adjust the position of back pad **400** and D-ring **150** to a desirable position for each user. Friction between straps **122** and **132** and back pad **400** typically prevents relative motion between back pad **400** and straps **122** and **132** during normal use. In the case of a fall, straps **122** and **132** become taut as described above. Moreover, back pad **400** slides to a different position. For example, in a foot-first fall, back pad **400** will slide upward (in the direction of the head of the user). In a head first fall, back pad **400** moves downward with respect to the user's body. Once the fall is arrested, the users body is caused to rotate and back pad **400** is caused to slide upward, coming to rest near the head of the user.

Friction between back pad **400** and straps **122** and **132** during movement of back pad **400** can result in heat damage or melting those areas of back pad **400** in contact with straps **122** and **132**. Further, movement of back pad **400** in either the upward or downward direction results in movement of back pad **400** in a direction of widening in the separation between straps **122** and **132**, thereby increasing the force exerted on back pad **400** (pulling to the outside or tensioning back pad **400**).

The increased force associated with increased tautness in straps **122** and **132** (whether, there is movement of back pad **400** relative to straps **122** and **132** or not) can be used to cause a change in the appearance (for example, distension or breaking) of back pad **400**. Although a change in appearance can occur in the case of a falls in back pads used in connection with some commercially available safety harnesses, in some cases the change in appearance is insubstantial and can be overlooked. In back pad **400** and other back pads of the present invention, structural stress points or weak points are built into back pad **400** to accentuate the change in appearance of back pad **400** in the case of a large force (for example, a load of at least 500 to 600 pounds of force) such that the change in appearance of back pad **400** is readily apparent in even a cursory inspection.

As for example illustrated in FIGS. **3**T and **3**U, one or more areas **480** of decreased thickness are formed in the material of back pad **400**. These areas of decreased thickness, channels or notches **480** create stress points that cause significant distention or stretching, or, more likely, breakage in the case of application of a substantial or large load as described above to safety harness **10**. As known to, for example, those in the materials arts, the load under with such distension or breakage occurs can be readily adjusted to a particular predetermined load by, for example, choice of the material or materials of back pad **400** and/or the dimensions of areas **480**. Indicators, such as arrows **484** can be provided to further draw attention to relatively thin areas or notches **480** for inspection. In the illustrated embodiment, relatively thin areas, channels or notches **480** are formed between upper and lower slots **405***a, b, e* and *f* and generally central slots **405***c* and *d*. As illustrated in, for example, FIG. **3**M, an indication of an unstressed width of channels or notches **480** (for example, ⅛ inch) can be provided as a reference to determine if distention or stressing has occurred.

D-ring attachment **410** (or other D-ring attachment of the present invention) will not typically be subjected to a force suitable to damage attachment **410**.

As, for example, illustrated by back pad **400***a* FIG. **4**A, areas **480***a* can be incorporated into a back pad that does not include a D-ring attachment **410** as described above and is not used in connection with a standalone D-ring attachment **410***a* as described above. In FIG. **4**A, areas **480***a* have been incorporated into the design of a standard hexagonal back pad used in a number of commercially available safety harnesses. Existing safety harness designs are readily retrofitted to incorporate back pad **480***a* as illustrated in FIG. **4**A. Moreover, many other back pads or strap guides used in safety harnesses are readily altered to include areas of decreased strength to provide a readily observable indication that a safety harness and thereby the back pad has undergone a predetermined load. Furthermore, the indicators of the present invention can reduce or eliminate false positives associated with many other types of fall indicators (that is, false indications of a fall when there has been no fall).

Further, a load indicator of the present invention need not be incorporated into the back pad of the safety harness. In that regard, a load indicator of the present invention need only be connected between two spaced straps of the safety harness such that the change in force exerted upon the load indicator in the case of a fall causes a readily observable change in appearance of the load indicator. The load indicator can include a first connector that is connected to the first strap and a second connector that is connected to the second strap.

FIGS. **8**A and **8**B, for example, illustrate a load indicator **500** wherein a first connector **510** includes slots **512** and **514** through which strap **22** of harness **10** passes (see FIG. **8**A), and a second connector **520** includes slots **522** and **524** through which strap **22** passes. Connectors **510** and **520** are connected by an intermediate member **530**. In the illustrated embodiment, the width of intermediate member decreases near the center thereof to provide a stress point as described above. Depending upon the material(s) chosen for load indicator **500**, there may be no need to create one or more stress points. FIG. **8**A also illustrates a second load indicator **500***a* that is similar in design and operation to load indicator **500**. Load indicator **500***a* is positioned above the position of the crossing point of straps **22** and **32** and load indicator **500** is positioned below the position of the crossing point of straps **22** and **32**.

The foregoing description and accompanying drawings set forth preferred embodiments of the invention at the present time. Various modifications, additions and alternative designs will, of course, become apparent to those skilled in the art in light of the foregoing teachings without departing from the scope of the invention. The scope of the invention is indicated by the following claims rather than by the foregoing description. All changes and variations that fall within the meaning and range of equivalency of the claims are to be embraced within their scope.

What is claimed is:

1. A back pad for use in connection with a safety harness comprising at least two spaced back straps and a connector adapted to be connected to a line or lanyard, the back pad comprising

a base comprising:

passages through which the two back straps can be passed to be crossed over the connector, said passages including a first upper slot for one back strap, and a second upper slot for the other back strap, said first and second upper slots having inner ends adjacent one another and outer ends opposite said inner ends;

a central upper slot spaced from the outer end of the first upper slot by a first area and spaced from the outer end of the second upper slot by a second area; and

load indicators at said first and second areas wherein said first and second areas are of reduced strength relative to adjacent areas of the base so that the first and second areas visibly distend or break upon the safety harness being subjected to a substantial load.

2. The back pad of claim **1** wherein the substantial load is at least approximately 450 pounds of force.

3. The back pad of claim **2** wherein the areas of reduced strength are areas having a thickness less than the thickness of the adjacent areas of the base.

4. The back pad of claim **1** wherein the base further includes:

a first lower slot through which the other back strap can be passed;

a second lower slot through which the one back strap can be passed;

said first and second lower slots having inner ends adjacent one another and outer ends opposite said inner ends;

a central lower slot spaced from the outer end of the first lower slot by a third area and spaced from the outer end of the second lower slot by a fourth area; and

load indicators at said third and fourth areas wherein said third and fourth areas are of reduced strength relative to adjacent areas of the base so that the third and fourth areas visibly distend or break upon the safety harness being subjected to a substantial load.

5. The back pad of claim **4** wherein the areas of reduced strength are areas having a thickness less than the thickness of the adjacent areas of the base.

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